Nokia Customer Care

Service Manual

DRAFT

RM-378; RM-379 (Nokia 7310)

Mobile Terminal

Part No: 9210365 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

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ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77° F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 7310 Service Manual Structure

1 General information
2 Service Devices and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 System Module
Glossary

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1 — General information

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Product selection

RM-378/379 is a GSM triple band phone, supporting EGSM850/1800/1900 bands(RM-378) and EGSM900/1800/1900 bands(RM-379), respectively..

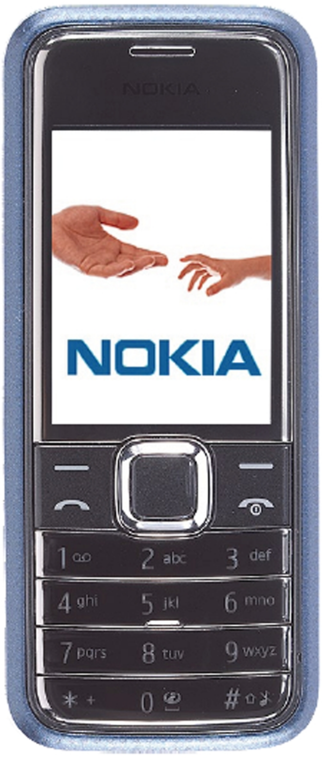

Figure 1 RM-378/379 product picture

Phone features

Display and keypad features

- 2” 240x320 pixel, 16M true colour display
- 5-way , navi-key (2 soft-keys, End/ Power on Key)

Hardware features

- 2-megapixel camera with 4x digital zoom
- TV-out function
- 2.5mm AV connector for stereo headset
- Micro USB port for data transfer (USB 2.0)
- Bluetooth 2.0 + EDR
- RDS Stereo radio and music player
- Internal vibrator and antenna
- Plug-in SIM (1.8 V and 3.0 V)
- MicroSD card hot swap slot (up to 4GB)
- Side volume keys with zoom functionality

RF features

- GSM/EGSM 850/1800/1900 (RM-378); GSM/EGSM 900/1800/1900 (RM-379)

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- EGPRS: MSC 32
- GPRS: MSC 32
- CSD

User interface and software features

Selection of software applications and services

- Audio messages
- 3GPP streaming / downloading video
- XHTML browsing over TCP/IP
- Themes (wallpapers, icons, colors)
- Music Player supporting MP3, AAC, ACC+, eAAC+ and WMA
- Nokia Xpress audio messaging (AMS)
- OMA DRM 2.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- Java
- MP3 ringing tones, true tones and MIDI ringing, alert and gaming tones with support of 64 polyphony
- Video ringing tones
- WAP 2.0, XHTML browser over HTTP/TCP/IP stack
- SyncML (local and remote)
- TWIN PC Suite

Accessories

Sales package contents

- Nokia 7310 phone
- Nokia Battery BL-4CT
- Nokia Charger: AC-6C
  (AC-6C and CA-100C for PRC)
- 2GB micro SD memory card (area dependent)
- Nokia wired stereo headset: HS-47
- CD rom
- User Guide

Table 1 Battery and chargers

Type	Name
Note: This phone is charged through the smaller charger Nokia standard interface (2.mm plug). The standard 3.5mm standard charger can be used together with the CA-44 charger adapter.	
AC-6C	Charger
BL-4CT	Battery 860 mAh Li-Ion

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Table 2 Headsets

Type	Name
HS-47	Stereo headset (wired)
HS-62	Stereo headset (wired)
HS-39W	Stereo headset (BT)
HS-71W	Stereo headset (BT)

Table 3 Data cables

Type	Name
CA-101	Micro USB cable

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2 — Service Devices and Service Concepts

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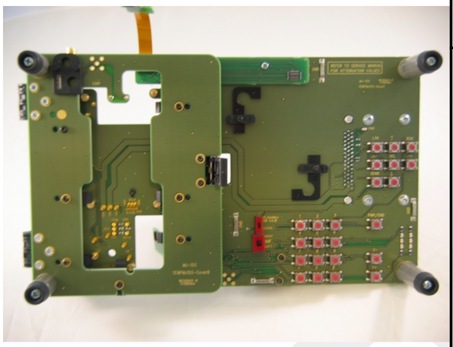
Service devices

Product specific devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-378; RM-379. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2"> </td><td>FS-71</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-71 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>MJ-155</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-155 is meant for component level troubleshooting.
The jig includes an RF interface for GSM and Bluetooth. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• MMC interface
• Duplicated SIM connector
• Connector for control unit
• Access for AV- and USB connectors</td></tr>
<tr><td rowspan="2"> </td><td>RJ-185</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-185 is a jig used for soldering and as a rework jig for the engine module.</td></tr>
</table>

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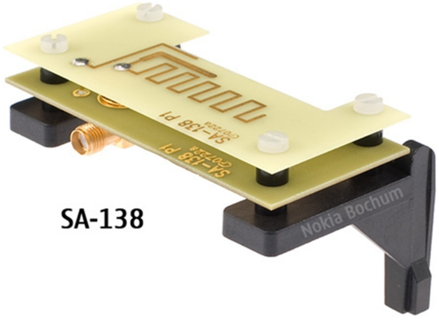

SA-138	RF coupler	

SA-138 is an RF coupler for GSM RF testing. It is used together with SS-46 and SS-62.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-138:

Band	Tuning channel	Attenuation RX (dB)	Attenuation TX(dB)
GSM850	128	8	12.8
	190	8	12
	251	8	10.7
GSM900	38	8	9.6
	124	8	8.7
	975	9	11.5
GSM1800	512	9	12.6(RM-378); 11.6(RM-379)
	698	9(RM-378); 10 (RM-379)	12.3(RM-378); 11.2(RM-379)
	885	9(RM-378); 10 (RM-379)	11.3(RM-378); 10.8(RM-379)
GSM1900	512	10(RM-378); 11 (RM-379)	9.7(RM-378); 10.5(RM-379)
	661	10(RM-378); 11 (RM-379)	9.7(RM-378); 10.6(RM-379)
	810	10	11.1(RM-378); 11.8(RM-379)

General devices

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-378; RM-379. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

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CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

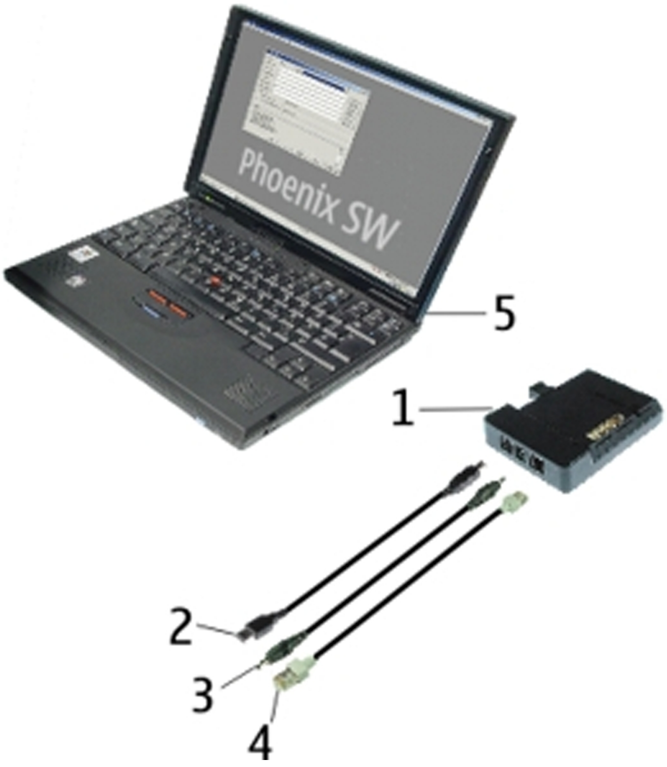
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.



Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

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	FLS-5	Flash device	
	FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use. **Note:** FLS-5 can be used as an alternative to PKD-1.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 and DCT-4 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable **Note:** FPS-21 is substitute FPS-10 if FPS-10 has not been set up.		
	PK-1	Software protection key	
	PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle. PK-1 is meant for use with a PC that does not have a series interface. To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.		

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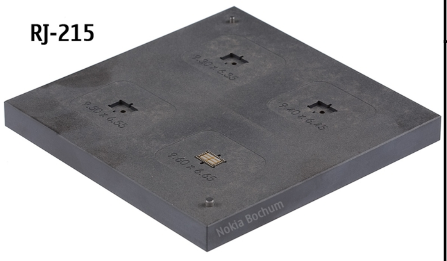
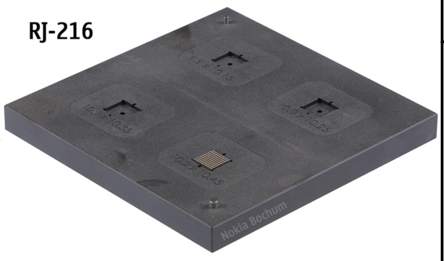
	PKD-1	SW security device	SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.
	RJ-215	Rework jig	RJ-215 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-66 stencil.
	RJ-216	Rework jig	RJ-216 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-67 stencil.
	SB-6	Bluetooth tester	The SB-6 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth.
	SPS-2	Soldering paste spreader	

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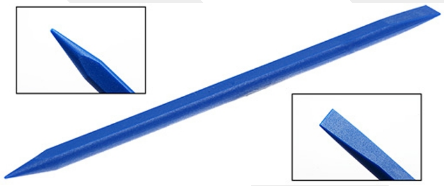
	SRT-6	Opening tool	SRT-6 is used to open phone covers.
	SS-46	Interface adapter	SS-46 acts as an interface adapter between the flash adapter and FPS-10.
	SS-62	Generic flash adapter base for BB5	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB
	SS-88	Camera removal tool	The camera removal tool SS-88 is used to remove/attach the front camera module from/to the socket.
	SS-93	Blue stick tool	SS-93 is used for general disassembly and assembly tasks.

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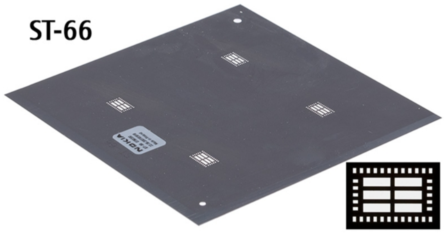
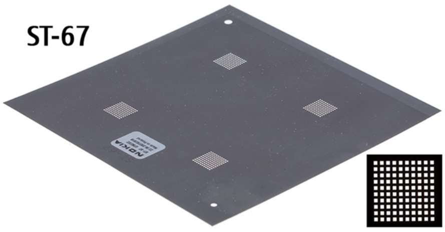
<table>
<tr><td rowspan="2"> </td><td>ST-66</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-66 is a rework stencil used with rework jig RJ-215.</td></tr>
<tr><td rowspan="2"> </td><td>ST-67</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-67 is a rework stencil used with rework jig RJ-216.</td></tr>
<tr><td rowspan="2"> </td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
</table>

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-378; RM-379. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">

CA-101
100cm

</td><td>CA-101</td><td>Micro USB cable</td><td></td></tr>
<tr><td colspan="3">The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.</td></tr>
</table>

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	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		
	PCS-1	Power cable	
	The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.		
	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		

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<table>
<tr><td rowspan="2"> </td><td>XRE-2</td><td>Bluetooth cable</td><td></td></tr>
<tr><td colspan="3">The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9.</td></tr>
<tr><td rowspan="2"> </td><td>XRF-1</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector ca. 610mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

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Service concepts

POS (Point of Sale) flash concept

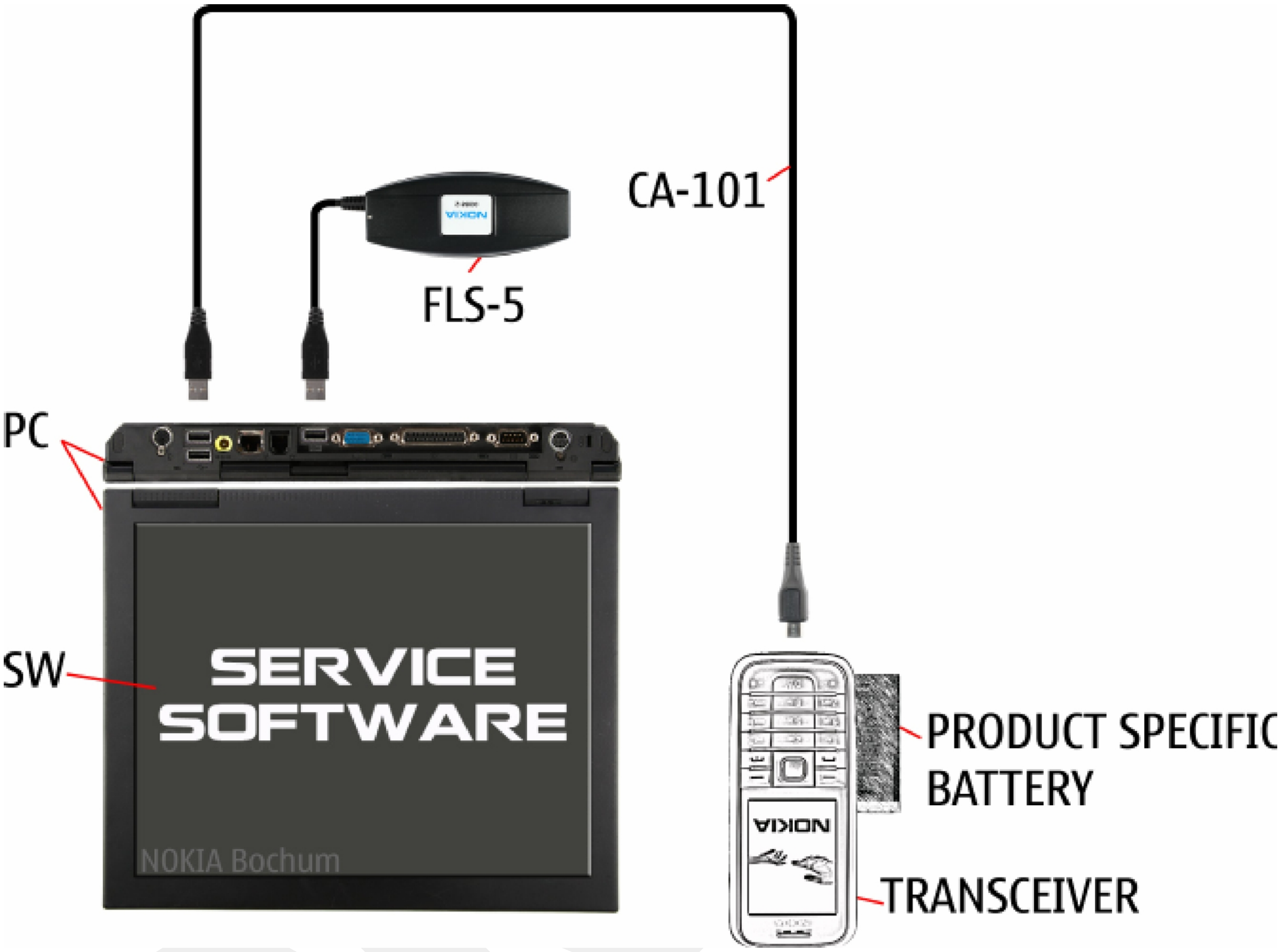
CA-101
FLS-5
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific tools	
BP-6P	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
CA-101	USB connectivity cable

Flash concept with FPS-10

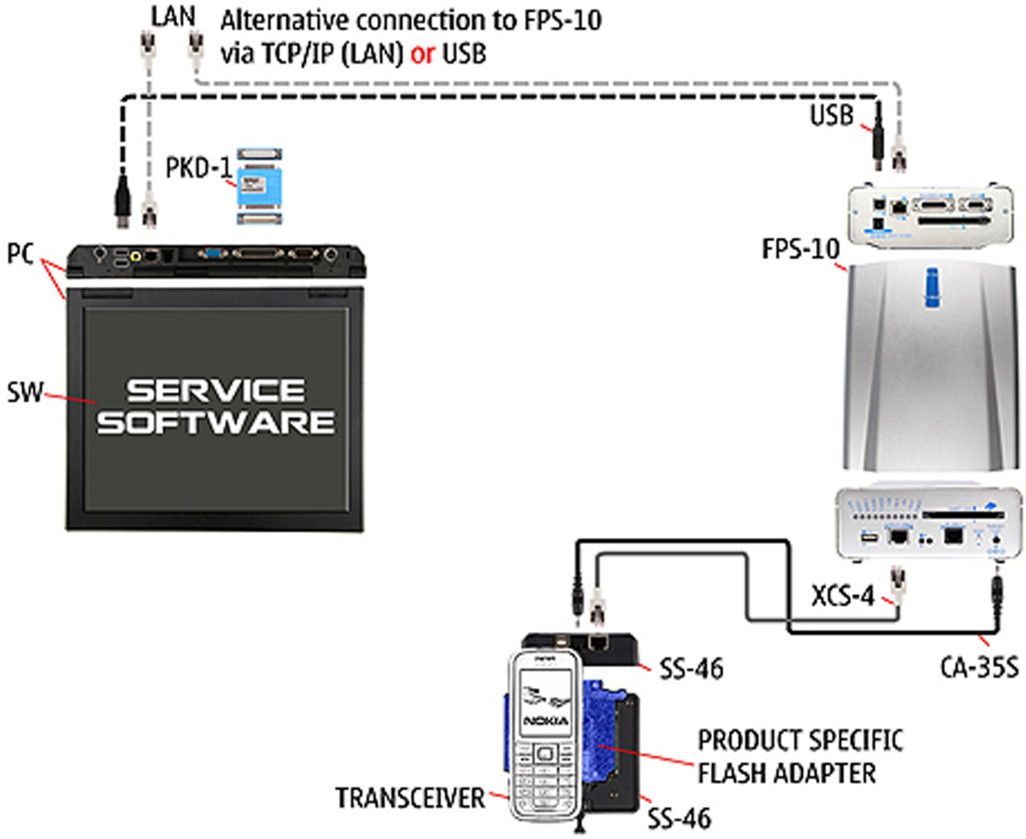
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
SW
SERVICE SOFTWARE
FPS-10
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-60	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

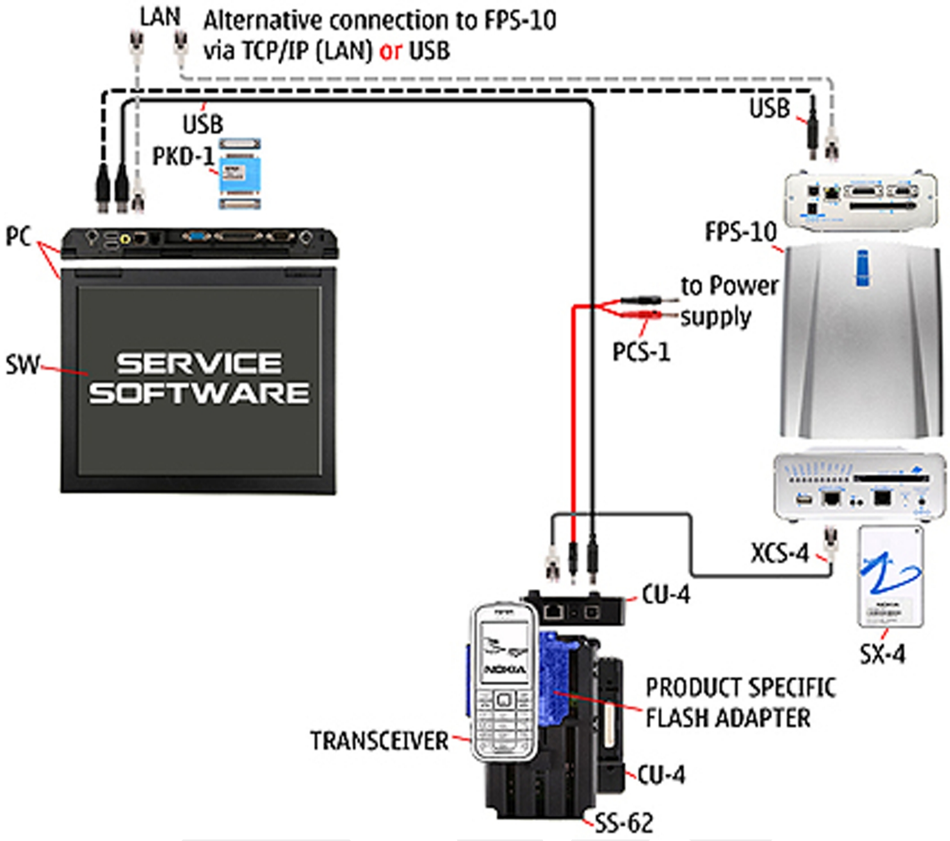
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-60	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

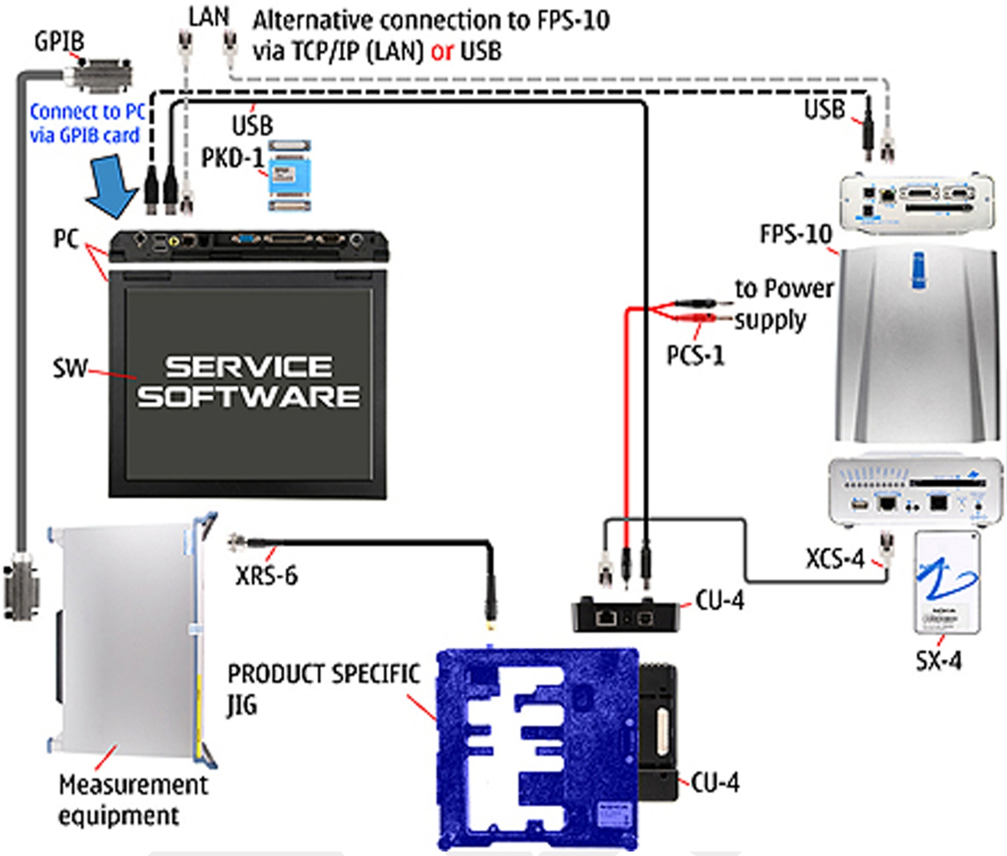
GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
JIG
CU-4
Measurement
equipment

Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-155	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable

Type	Description
	GPIB control cable

RF testing concept with RF coupler

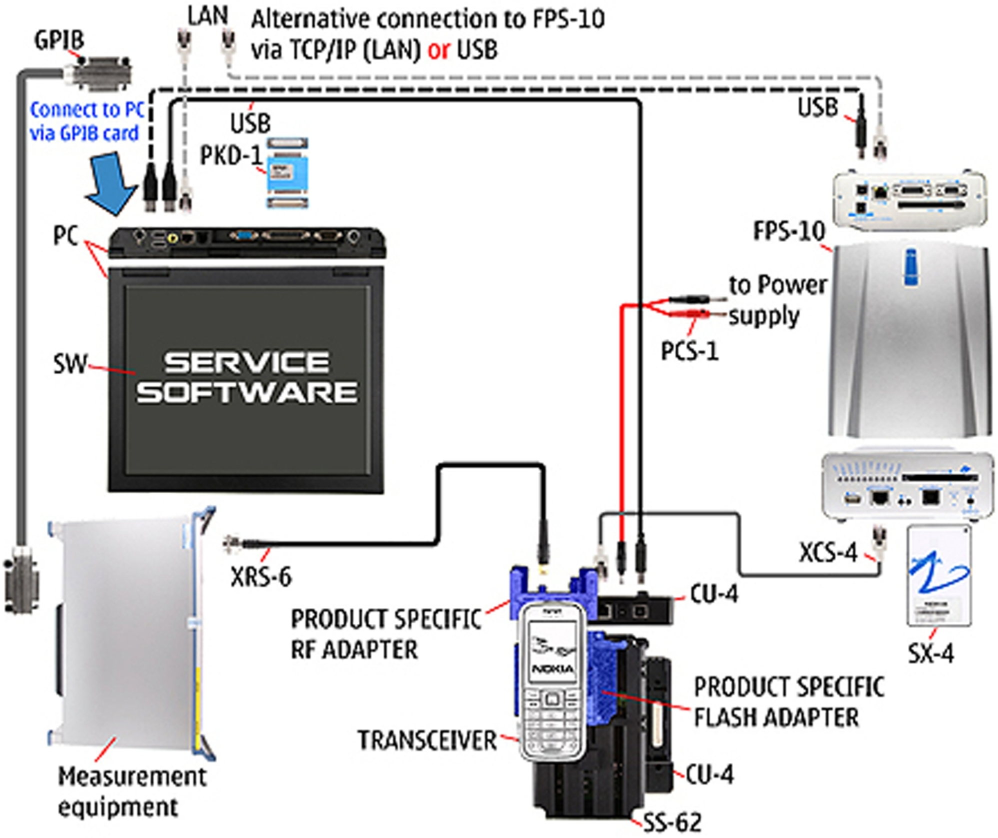
GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC
RF ADAPTER
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement
equipment
SS-62

Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-60	Flash adapter
SA-xx	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

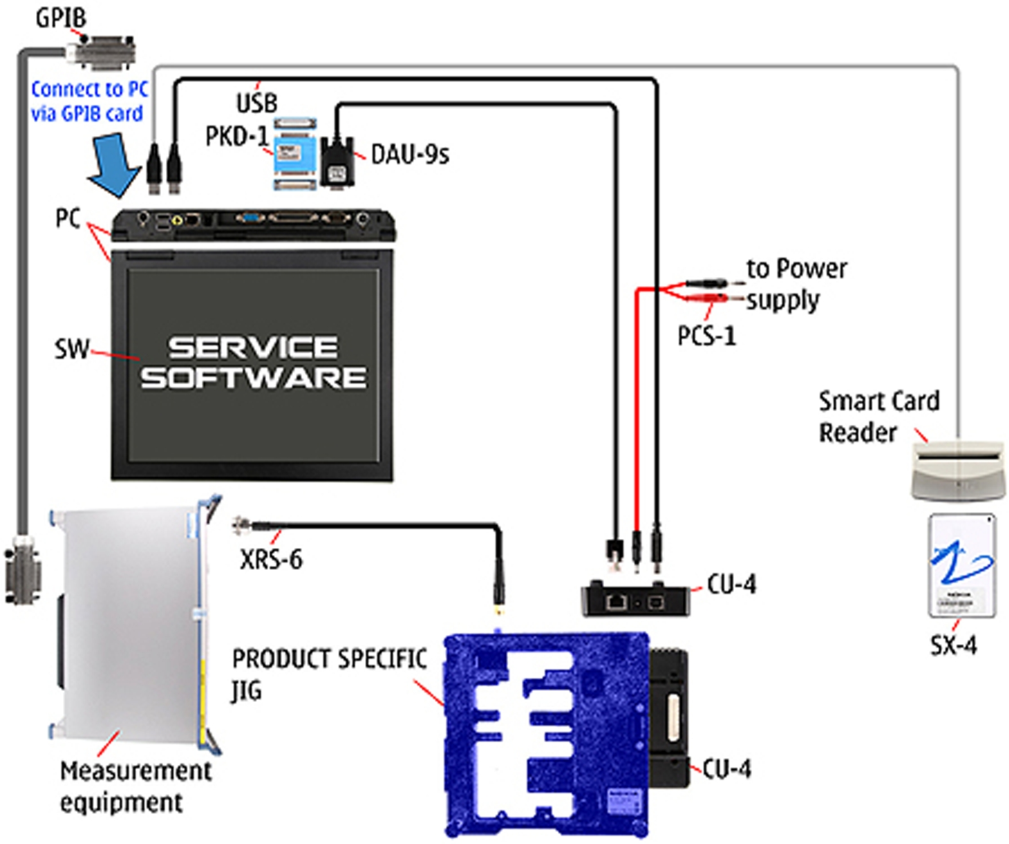
GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
to Power supply
PCS-1
SW
SERVICE SOFTWARE
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-155	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

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3 — BB Troubleshooting and Manual Tuning Guide

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Power and charging troubleshooting 3–7
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Baseband self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

> **Note:** Rework attention:
>
> To prevent G2200 from explosion, always place metal sheet on it or remove G2200 from PWB before re-work any components nearby G2200.

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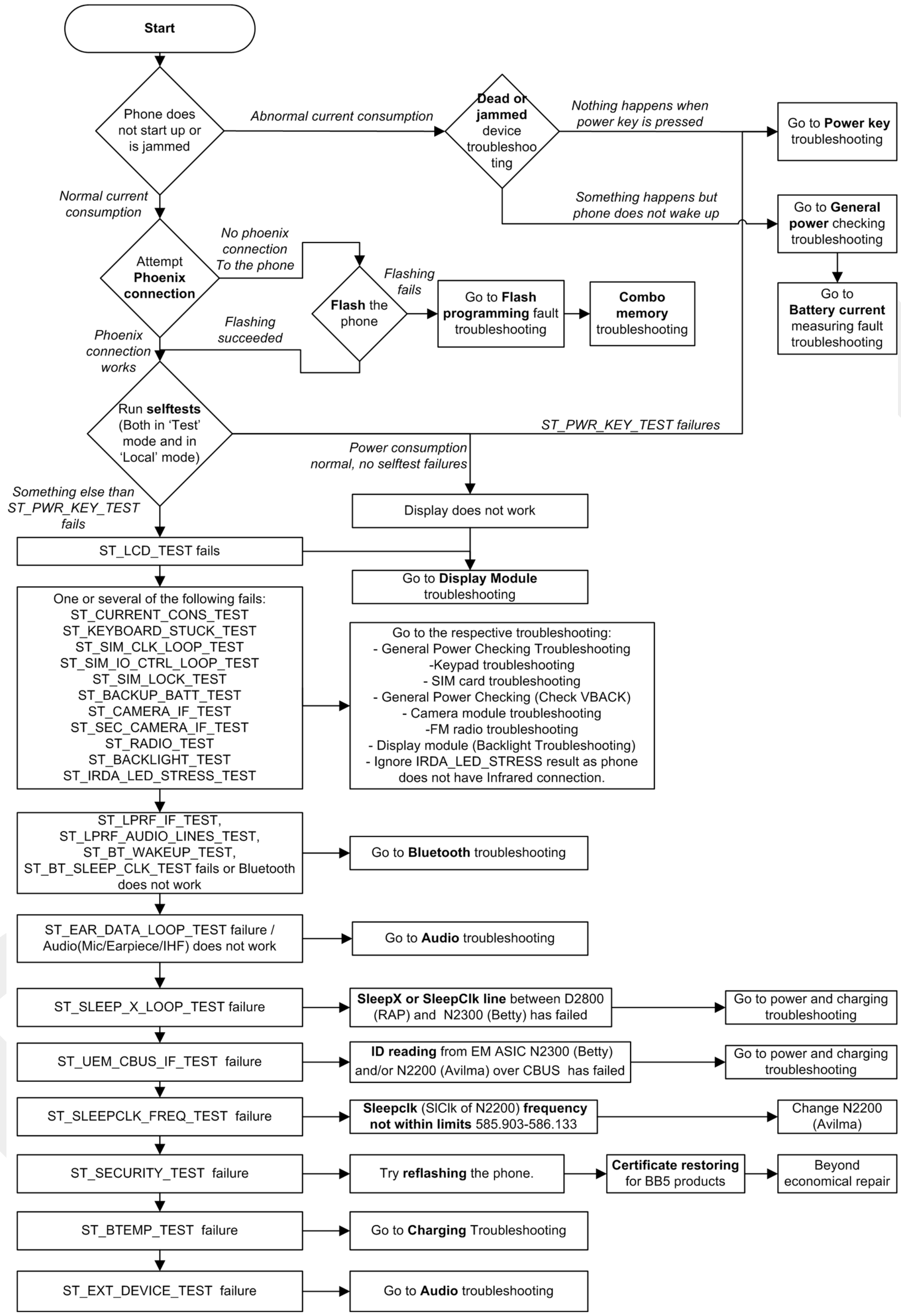
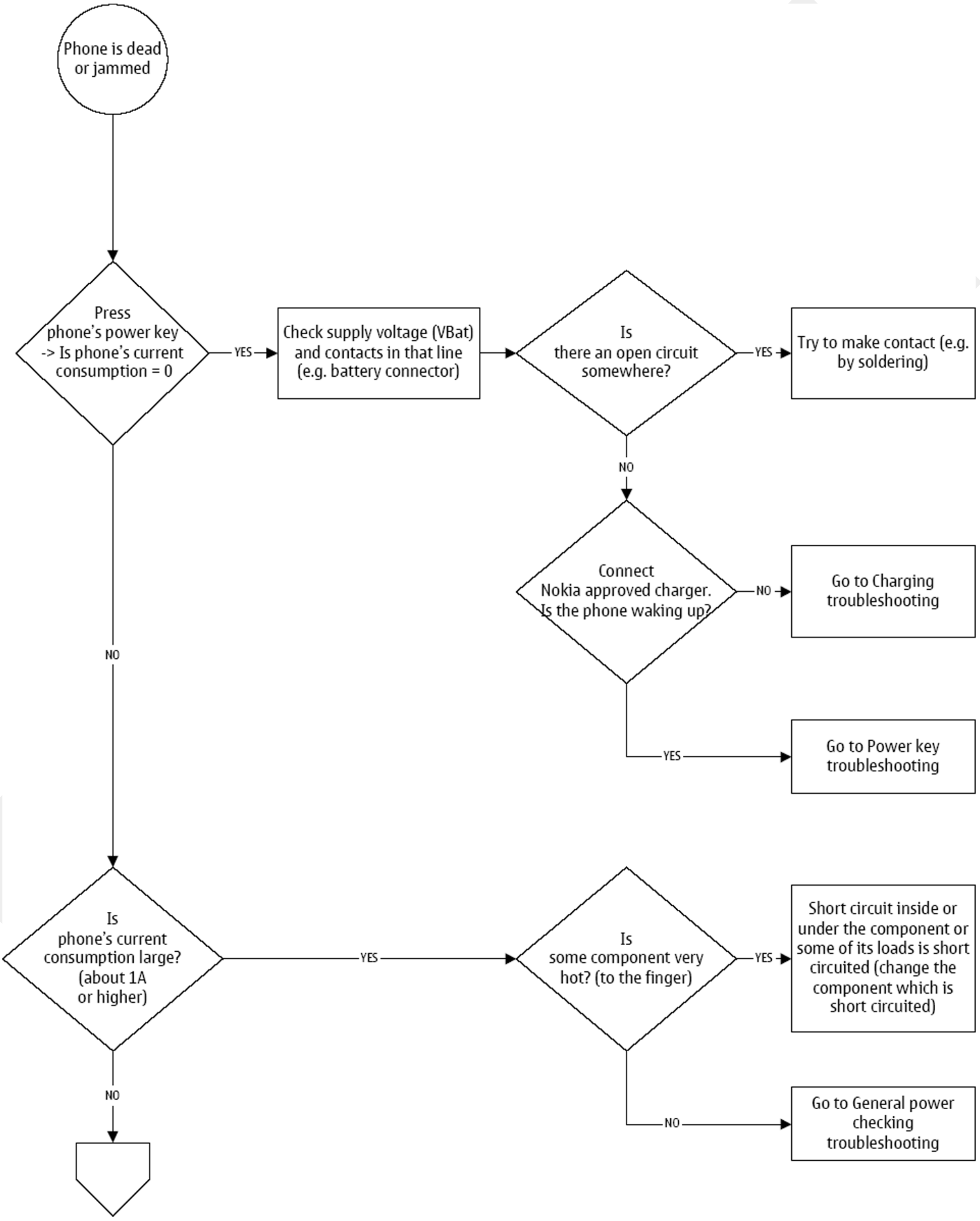
Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens when power key is pressed
Go to Power key troubleshooting
Something happens but phone does not wake up
Go to General power checking troubleshooting
Go to Battery current measuring fault troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Flash the phone
Flashing fails
Go to Flash programming fault troubleshooting
Combo memory troubleshooting
Flashing succeeded
Phoenix connection works
Run selftests (Both in 'Test' mode and in 'Local' mode)
ST_PWR_KEY_TEST failures
Power consumption normal, no selftest failures
Display does not work
Something else than ST_PWR_KEY_TEST fails
ST_LCD_TEST fails
Go to Display Module troubleshooting
One or several of the following fails: ST_CURRENT_CONS_TEST ST_KEYBOARD_STUCK_TEST ST_SIM_CLK_LOOP_TEST ST_SIM_IO_CTRL_LOOP_TEST ST_SIM_LOCK_TEST ST_BACKUP_BATT_TEST ST_CAMERA_IF_TEST ST_SEC_CAMERA_IF_TEST ST_RADIO_TEST ST_BACKLIGHT_TEST ST_IRDA_LED_STRESS_TEST
Go to the respective troubleshooting: - General Power Checking Troubleshooting -Keypad troubleshooting - SIM card troubleshooting - General Power Checking (Check VBACK) - Camera module troubleshooting -FM radio troubleshooting - Display module (Backlight Troubleshooting) - Ignore IRDA_LED_STRESS result as phone does not have Infrared connection.
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST, ST_BT_WAKEUP_TEST, ST_BT_SLEEP_CLK_TEST fails or Bluetooth does not work
Go to Bluetooth troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Go to Audio troubleshooting
ST_SLEEP_X_LOOP_TEST failure
SleepX or SleepClk line between D2800 (RAP) and N2300 (Betty) has failed
Go to power and charging troubleshooting
ST_UEM_CBUS_IF_TEST failure
ID reading from EM ASIC N2300 (Betty) and/or N2200 (Avilma) over CBUS has failed
Go to power and charging troubleshooting
ST_SLEEPCLK_FREQ_TEST failure
Sleepclk (SlClk of N2200) frequency not within limits 585.903-586.133
Change N2200 (Avilma)
ST_SECURITY_TEST failure
Try reflashing the phone.
Certificate restoring for BB5 products
Beyond economical repair
ST_BTEMP_TEST failure
Go to Charging Troubleshooting
ST_EXT_DEVICE_TEST failure
Go to Audio troubleshooting

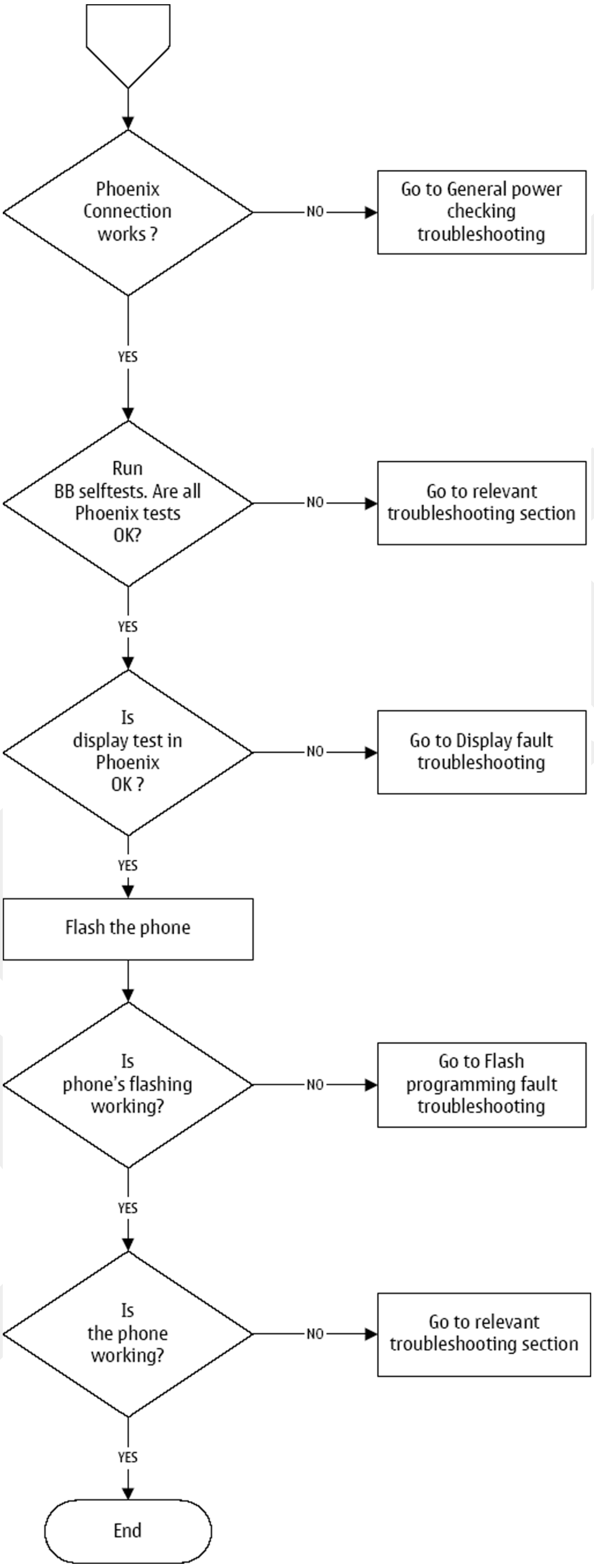
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there an open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO

Troubleshooting flow


Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

General power checking

Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILM	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.5	Camera, ALS, Display	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators, RFIC	
VRFC	AVILMA	OFF	ON	1.8	RAP3G converters	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 1.25 1.35 1.40	RAP3G digital	
VOUT	BETTY	OFF	OFF	2.5		Accessory connected
VLEDOUT	TPS61061/ N2301	OFF	OFF	14.5	LCD Backlight	Disabled in sleep

Charging troubleshooting

Troubleshooting flow

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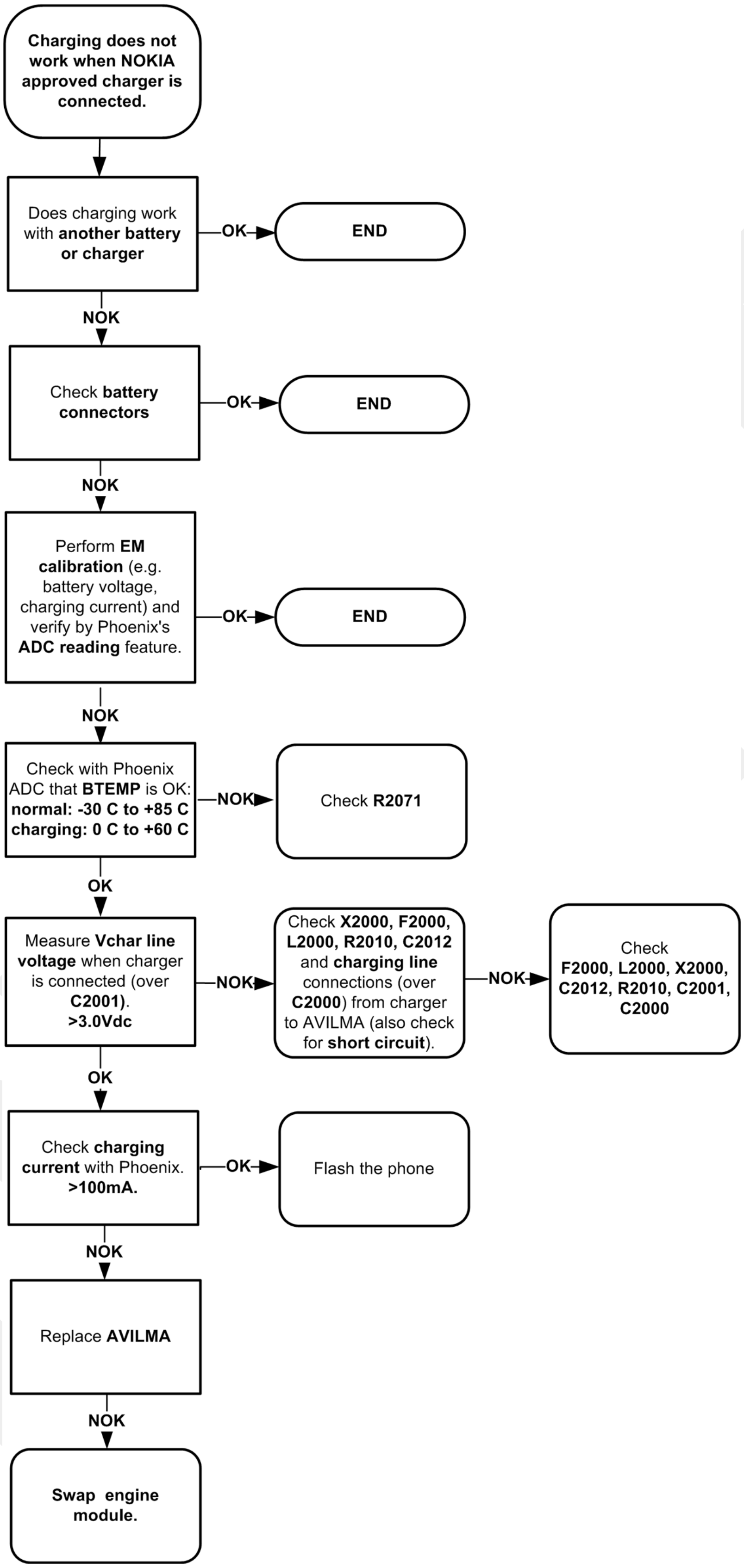
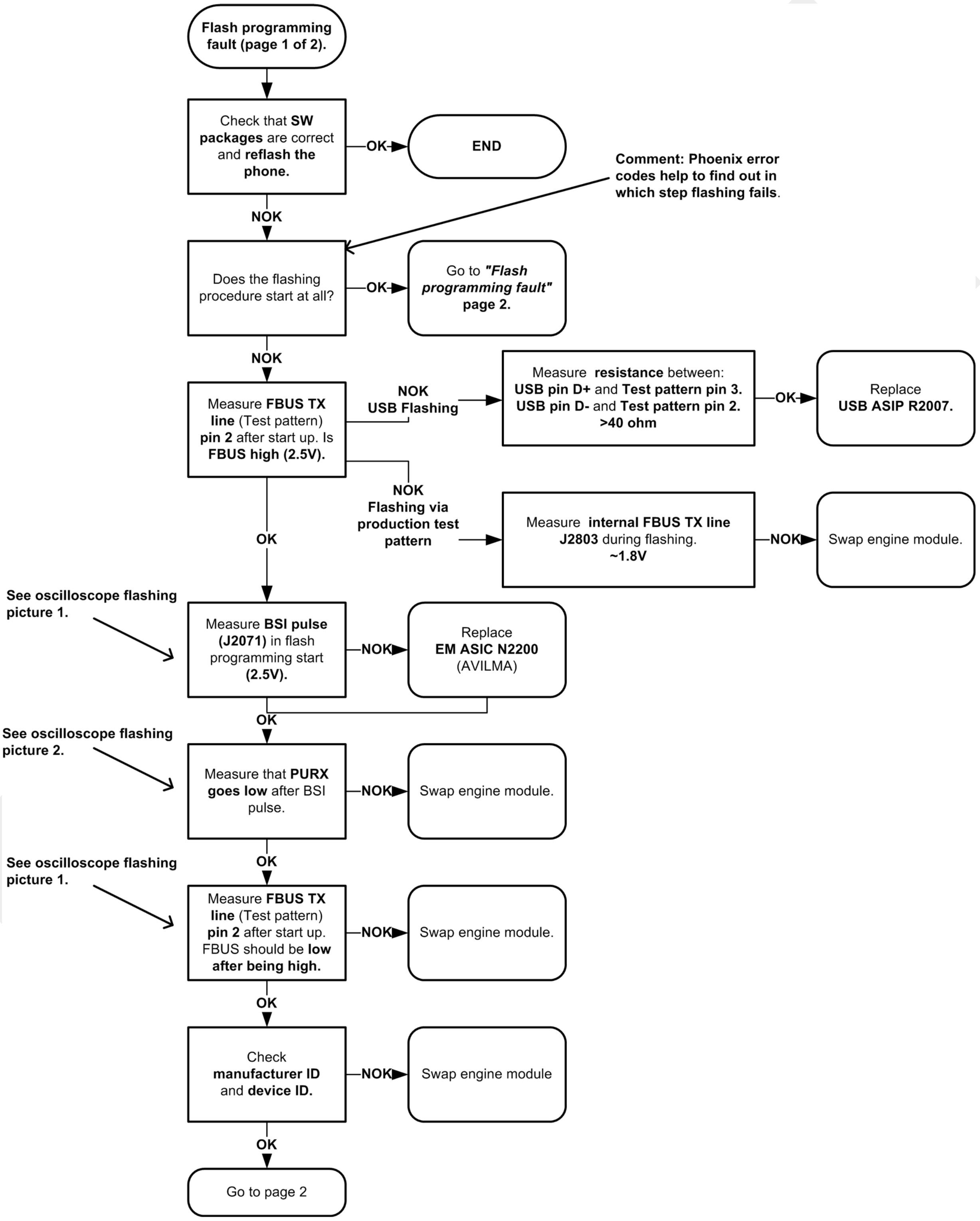

Charging does not work when NOKIA approved charger is connected.
Does charging work with another battery or charger
OK
END
NOK
Check battery connectors
OK
END
NOK
Perform EM calibration (e.g. battery voltage, charging current) and verify by Phoenix's ADC reading feature.
OK
END
NOK
Check with Phoenix ADC that BTEMP is OK: normal: -30 C to +85 C charging: 0 C to +60 C
NOK
Check R2071
OK
Measure Vchar line voltage when charger is connected (over C2001). >3.0Vdc
NOK
Check X2000, F2000, L2000, R2010, C2012 and charging line connections (over C2000) from charger to AVILMA (also check for short circuit).
NOK
Check F2000, L2000, X2000, C2012, R2010, C2001, C2000
OK
Check charging current with Phoenix. >100mA.
OK
Flash the phone
NOK
Replace AVILMA
NOK
Swap engine module.

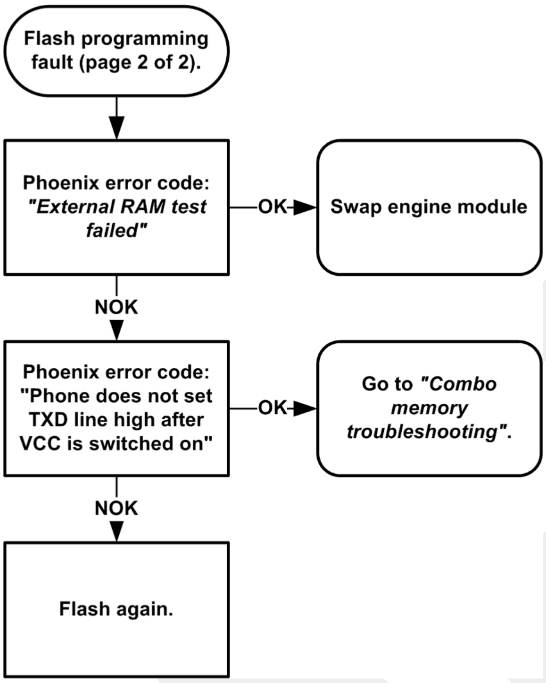
Interface troubleshooting

Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
Comment: Phoenix error codes help to find out in which step flashing fails.
NOK
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V).
NOK USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP R2007.
NOK Flashing via production test pattern
Measure internal FBUS TX line J2803 during flashing. ~1.8V
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure BSI pulse (J2071) in flash programming start (2.5V).
NOK
Replace EM ASIC N2200 (AVILMA)
OK
See oscilloscope flashing picture 2.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Swap engine module
OK
Go to page 2

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to *"Combo memory troubleshooting"*.
NOK
Flash again.

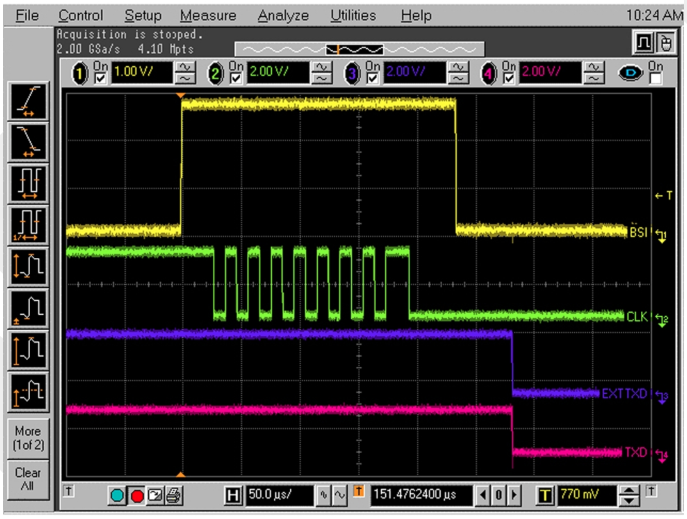

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
Acquisition is stopped.
2.00 GSa/s 4.10 Mpts
1.00 V/
2.00 V/
2.00 V/
2.00 V/
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
50.0 µs/
151.4762400 µs
770 mV

Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

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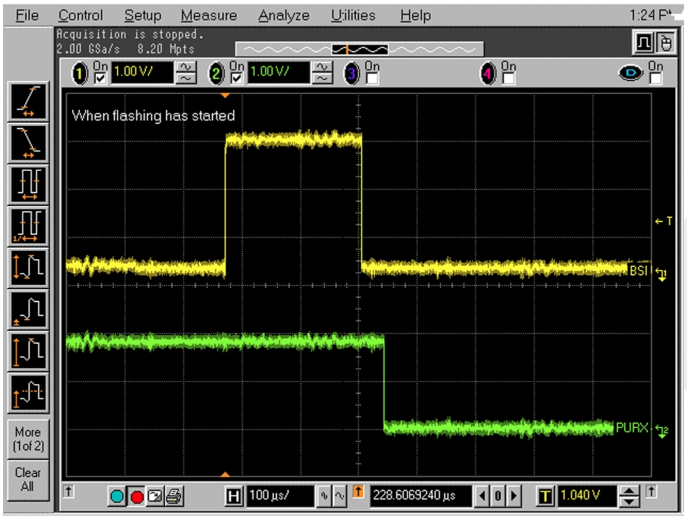
File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 P
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts
1 On 1.00 V/
2 On 1.00 V/
3 On
4 On
On
When flashing has started
T
BSI
PURX
More (1of 2)
Clear All
H 100 µs/
228.6069240 µs
0
T 1.040 V

Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

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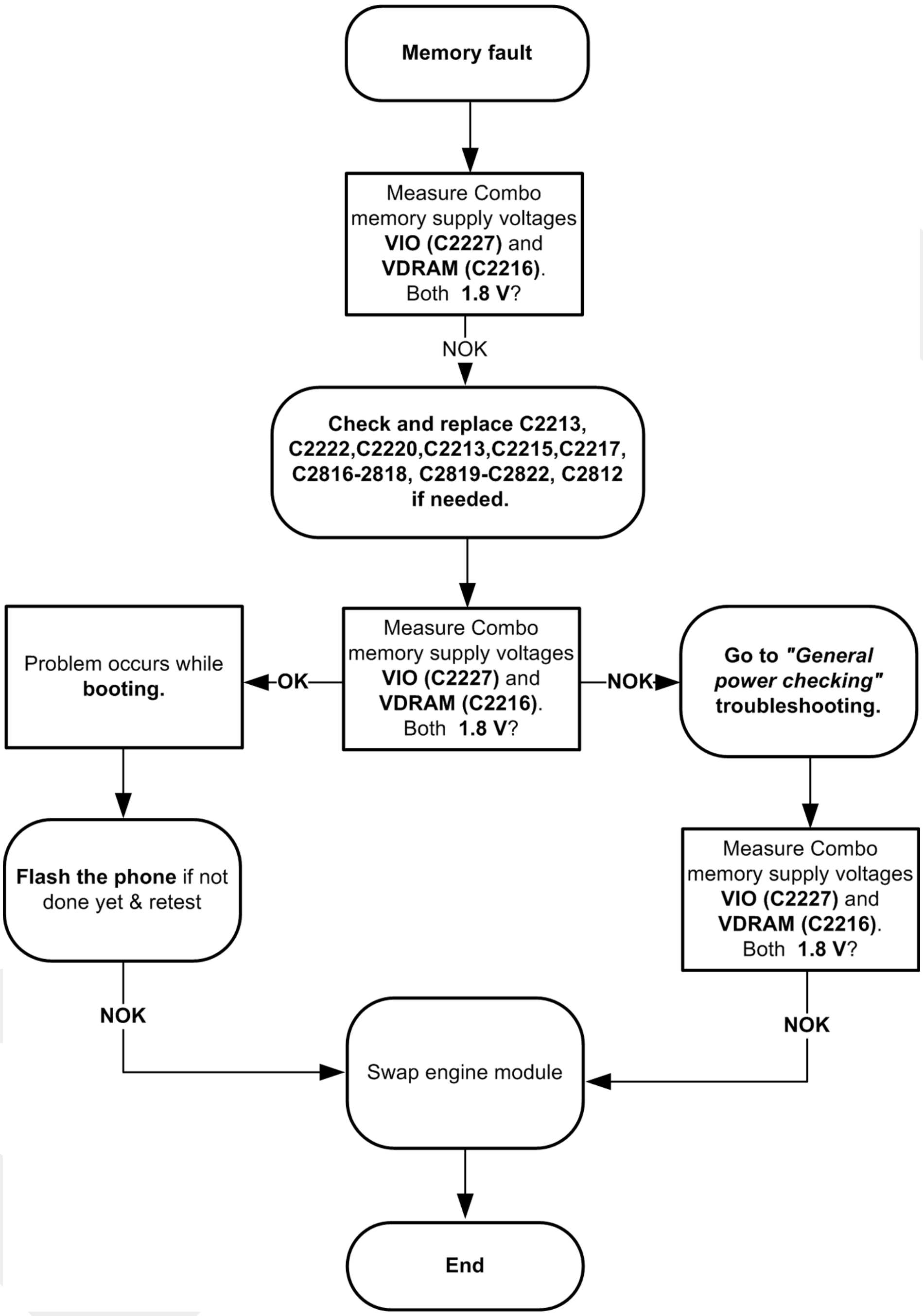
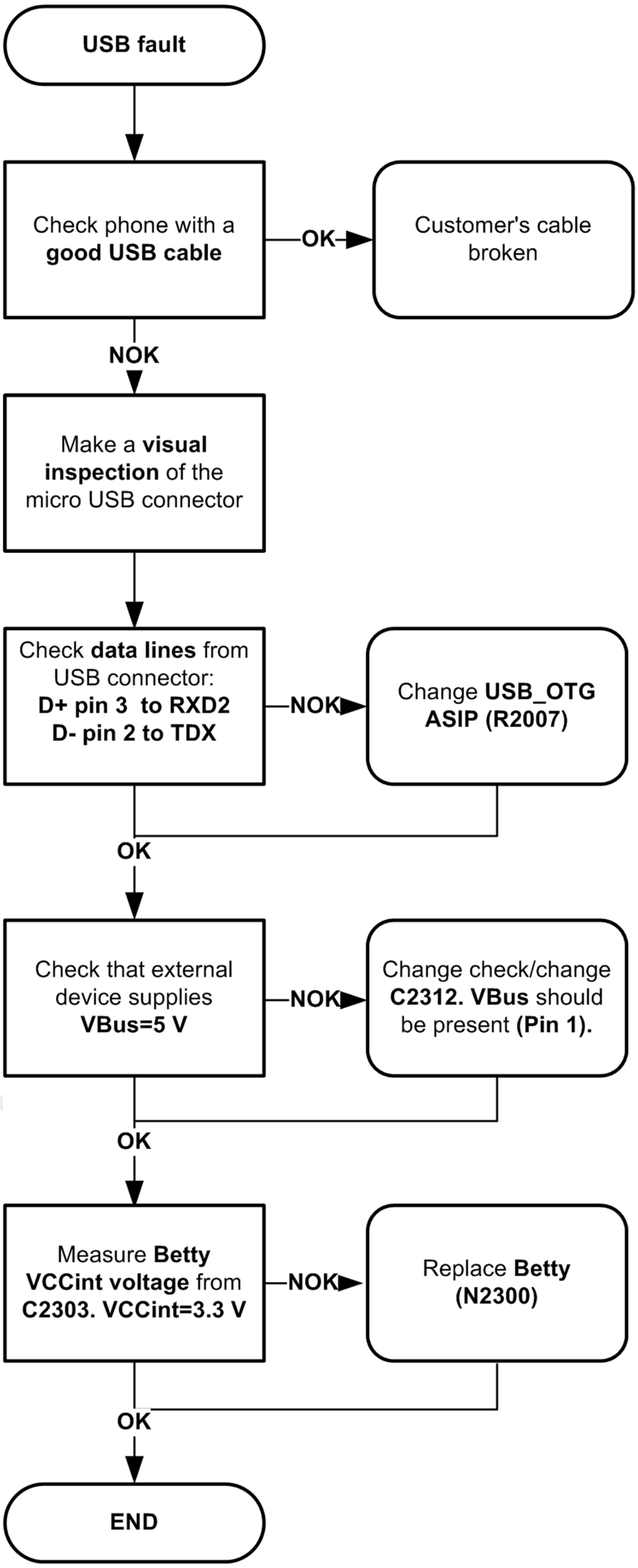
Combo memory troubleshooting

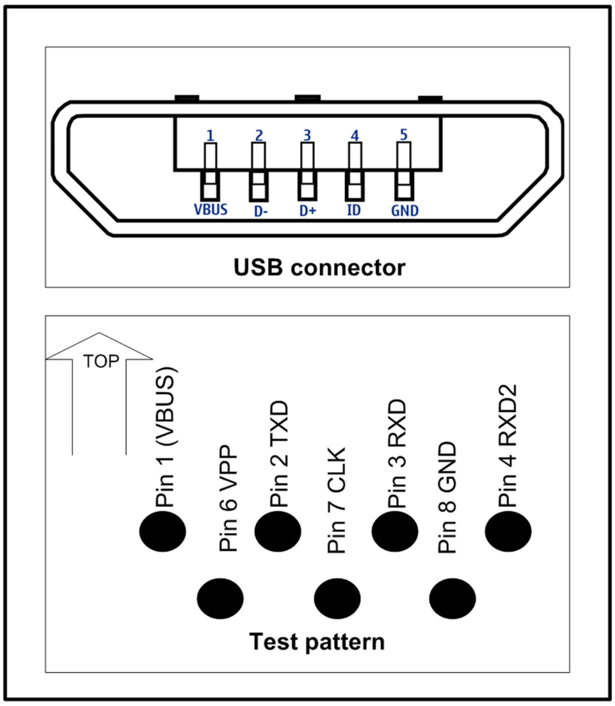
Troubleshooting flow


Memory fault
Measure Combo memory supply voltages VIO (C2227) and VDRAM (C2216). Both 1.8 V?
NOK
Check and replace C2213, C2222,C2220,C2213,C2215,C2217, C2816-2818, C2819-C2822, C2812 if needed.
Measure Combo memory supply voltages VIO (C2227) and VDRAM (C2216). Both 1.8 V?
OK
Problem occurs while booting.
NOK
Go to "General power checking" troubleshooting.
Flash the phone if not done yet & retest
Measure Combo memory supply voltages VIO (C2227) and VDRAM (C2216). Both 1.8 V?
NOK
Swap engine module
NOK
End

USB interface troubleshooting

Troubleshooting flow


USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the micro USB connector
Check data lines from USB connector:
D+ pin 3 to RXD2
D- pin 2 to TDX
NOK
Change USB_OTG ASIP (R2007)
OK
Check that external device supplies VBus=5 V
NOK
Change check/change C2312. VBus should be present (Pin 1).
OK
Measure Betty VCCint voltage from C2303. VCCint=3.3 V
NOK
Replace Betty (N2300)
OK
END

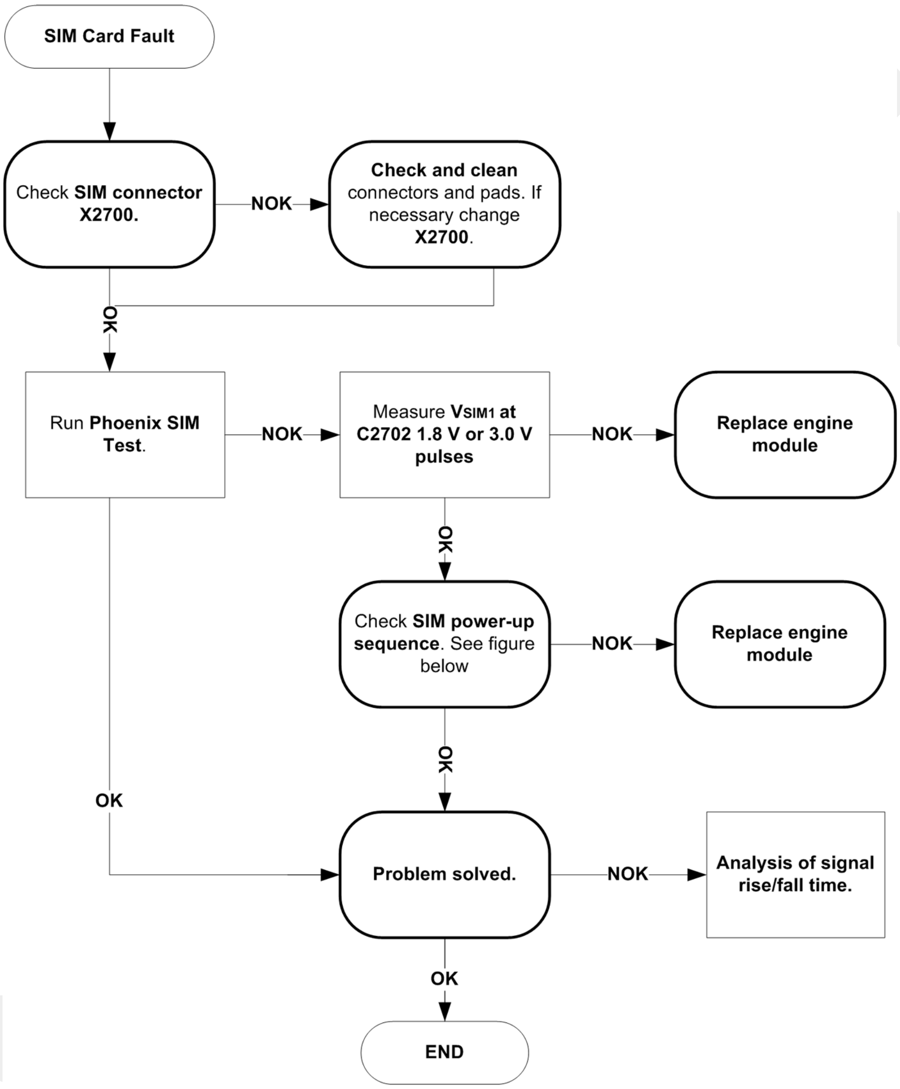

1
2
3
4
5
VBUS
D-
D+
ID
GND
TOP
Pin 1 (VBUS)
Pin 6 VPP
Pin 2 TXD
Pin 7 CLK
Pin 3 RXD
Pin 8 GND
Pin 4 RXD2

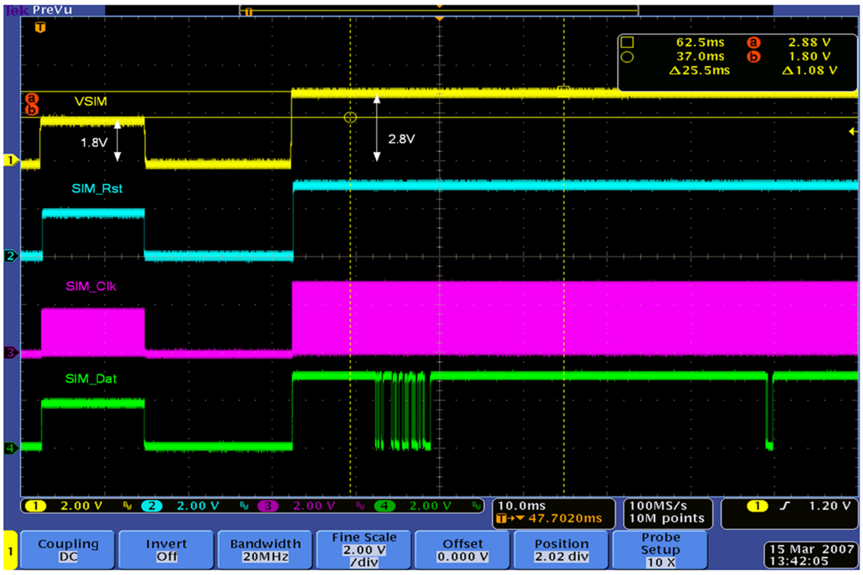
USB connector

Test pattern

SIM card troubleshooting

Troubleshooting flow


SIM Card Fault
Check SIM connector X2700.
NOK
Check and clean connectors and pads. If necessary change X2700.
OK
Run Phoenix SIM Test.
NOK
Measure VSIM1 at C2702 1.8 V or 3.0 V pulses
NOK
Replace engine module
OK
Check SIM power-up sequence. See figure below
NOK
Replace engine module
OK
OK
Problem solved.
NOK
Analysis of signal rise/fall time.
OK
END



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User interface troubleshooting

Keypad troubleshooting

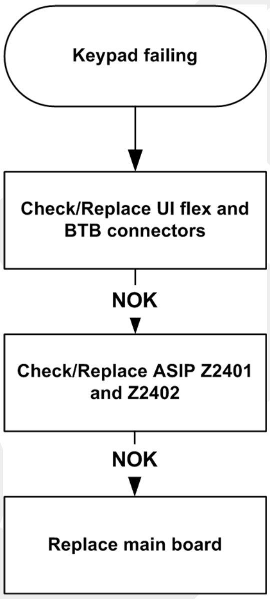
Context

There are two possible failure modes in the keyboard module:

- One or more keys are stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)
- Malfunction of several keys at the same time; this happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow


Keypad failing
Check/Replace UI flex and BTB connectors
NOK
Check/Replace ASIP Z2401 and Z2402
NOK
Replace main board

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 4 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.

Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 5 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

There are three different display fault cases;

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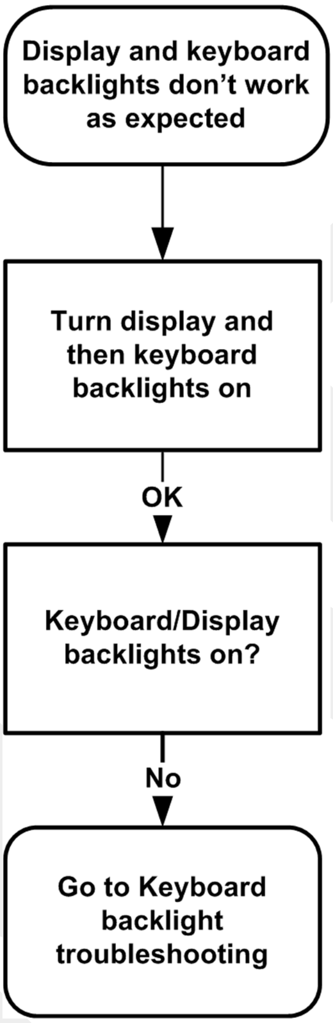
1. No backlights when image is on
2. No image when backlight is on
3. No backlight and no image

Troubleshooting flow


Display and keyboard backlights don't work as expected
Turn display and then keyboard backlights on
OK
Keyboard/Display backlights on?
No
Go to Keyboard backlight troubleshooting

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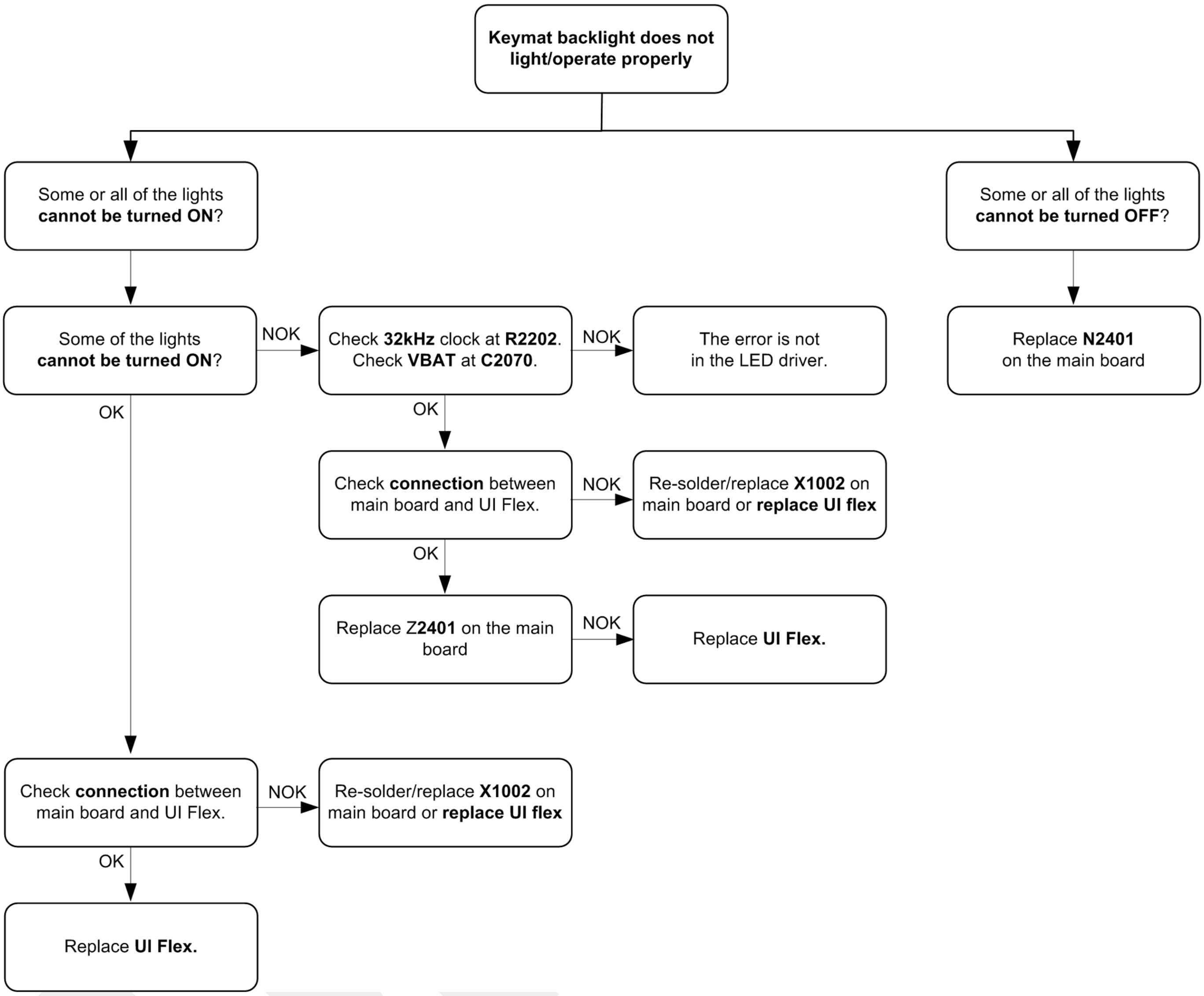
Keyboard backlight troubleshooting

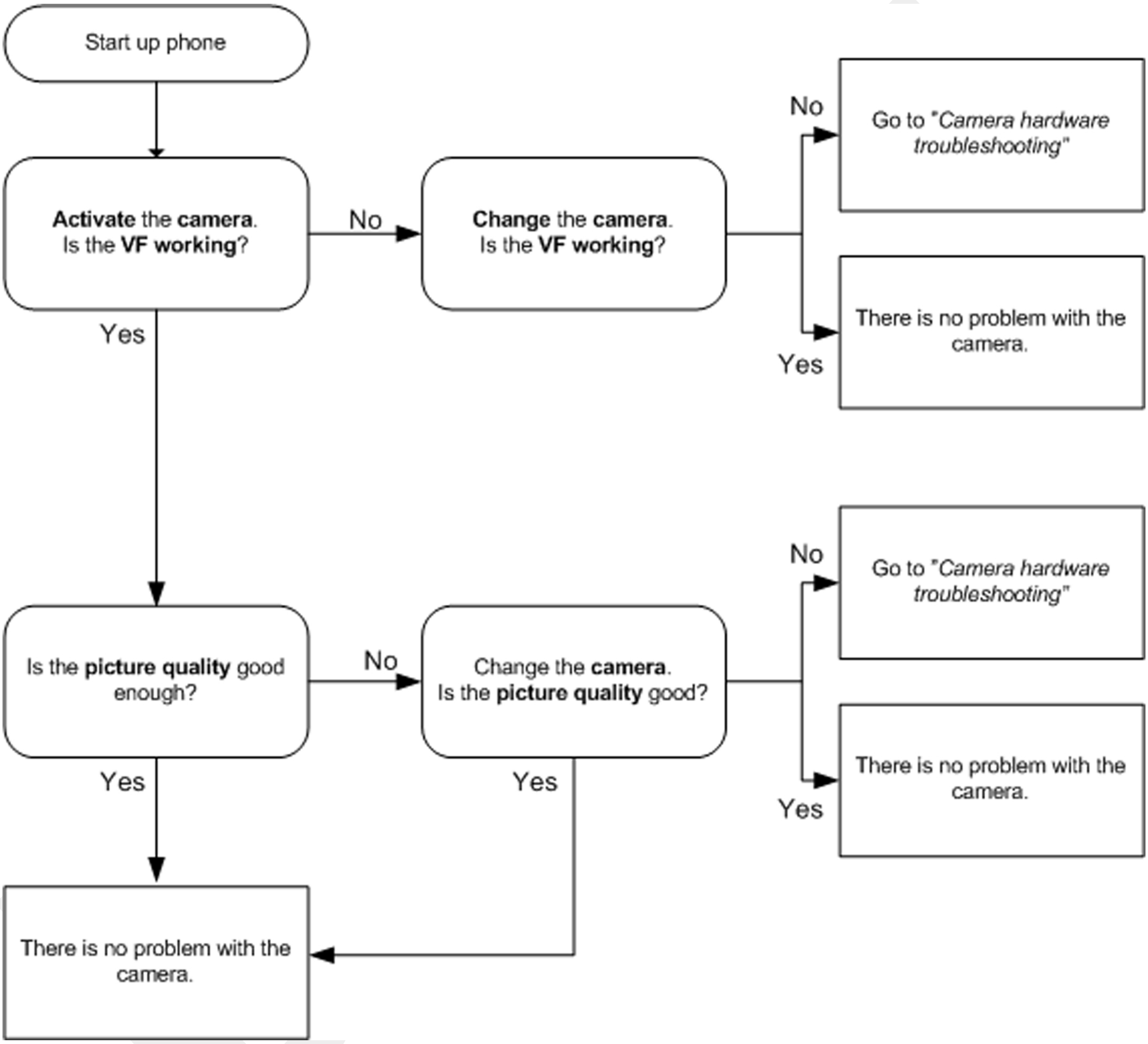
Troubleshooting flow


Keymat backlight does not light/operate properly
Some or all of the lights **cannot be turned ON**?
Some or all of the lights **cannot be turned OFF**?
Some of the lights **cannot be turned ON**?
NOK
Check **32kHz** clock at **R2202**. Check **VBAT** at **C2070**.
NOK
The error is not in the LED driver.
Replace **N2401** on the main board
OK
OK
Check **connection** between main board and UI Flex.
NOK
Re-solder/replace **X1002** on main board or **replace UI flex**
OK
Replace Z**2401** on the main board
NOK
Replace **UI Flex.**
Check **connection** between main board and UI Flex.
NOK
Re-solder/replace **X1002** on main board or **replace UI flex**
OK
Replace **UI Flex.**

Camera troubleshooting

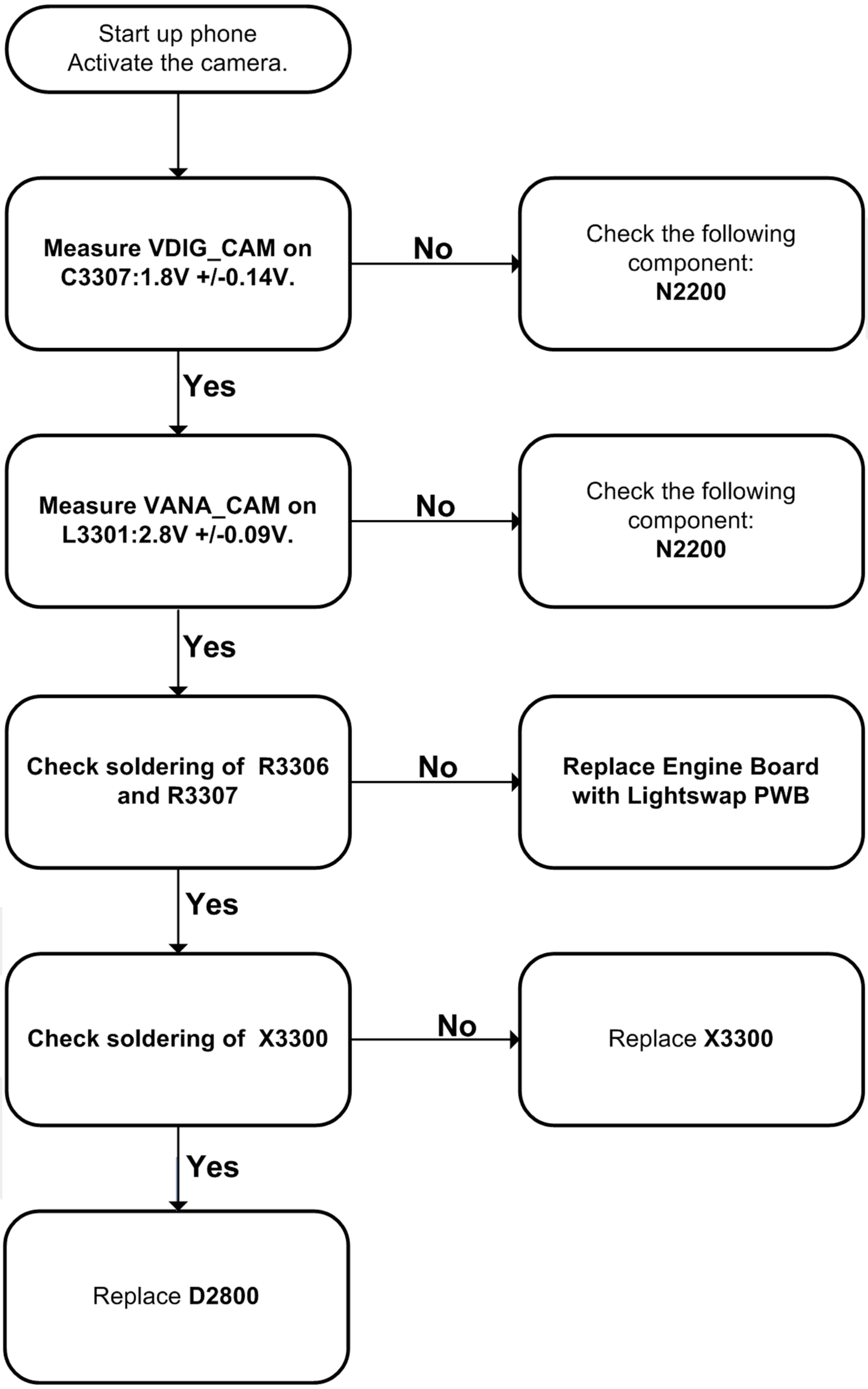
Camera troubleshooting

Troubleshooting flow


Start up phone
Activate the **camera**. Is the **VF working**?
No
Change the **camera**. Is the **VF working**?
No
Go to "*Camera hardware troubleshooting*"
Yes
There is no problem with the camera.
Yes
Is the **picture quality** good enough?
No
Change the **camera**. Is the **picture quality** good?
No
Go to "*Camera hardware troubleshooting*"
Yes
There is no problem with the camera.
Yes
Yes
There is no problem with the camera.

Camera hardware troubleshooting

Troubleshooting flow


Start up phone
Activate the camera.
Measure VDIG_CAM on C3307:1.8V +/-0.14V.
No
Check the following component: N2200
Yes
Measure VANA_CAM on L3301:2.8V +/-0.09V.
No
Check the following component: N2200
Yes
Check soldering of R3306 and R3307
No
Replace Engine Board with Lightswap PWB
Yes
Check soldering of X3300
No
Replace X3300
Yes
Replace D2800

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Sound level meter
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

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Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2152 and B2153 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2152 and B2153 pads					
Internal Mic to External Earpiece	B2150 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					

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Measurement data

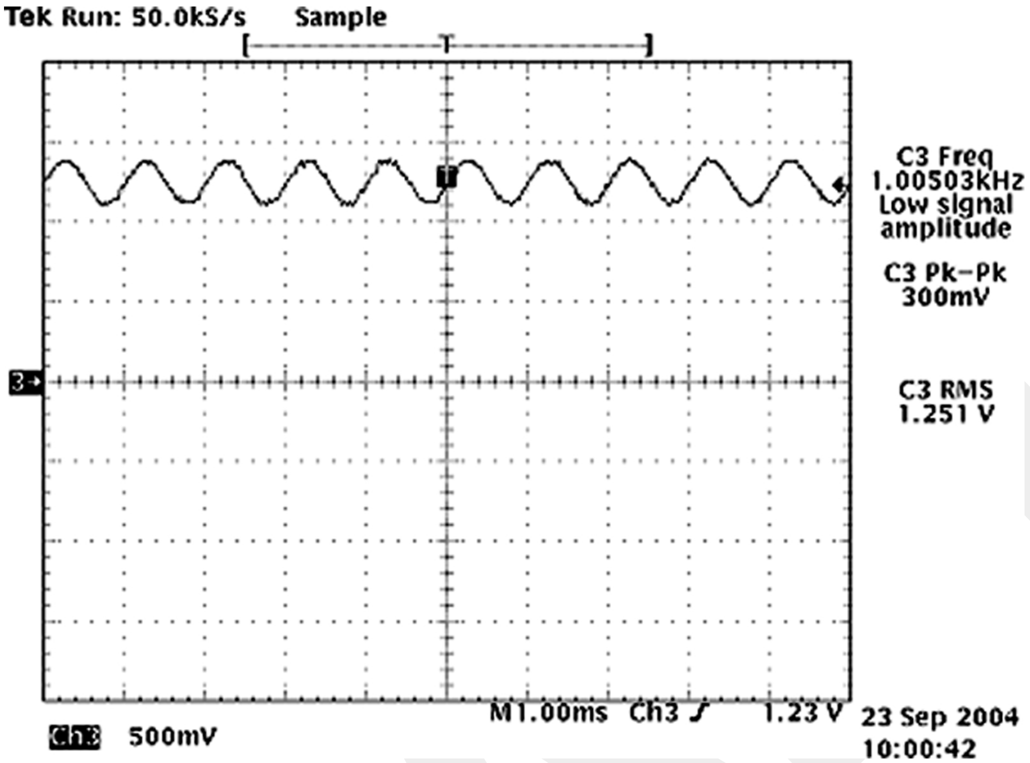
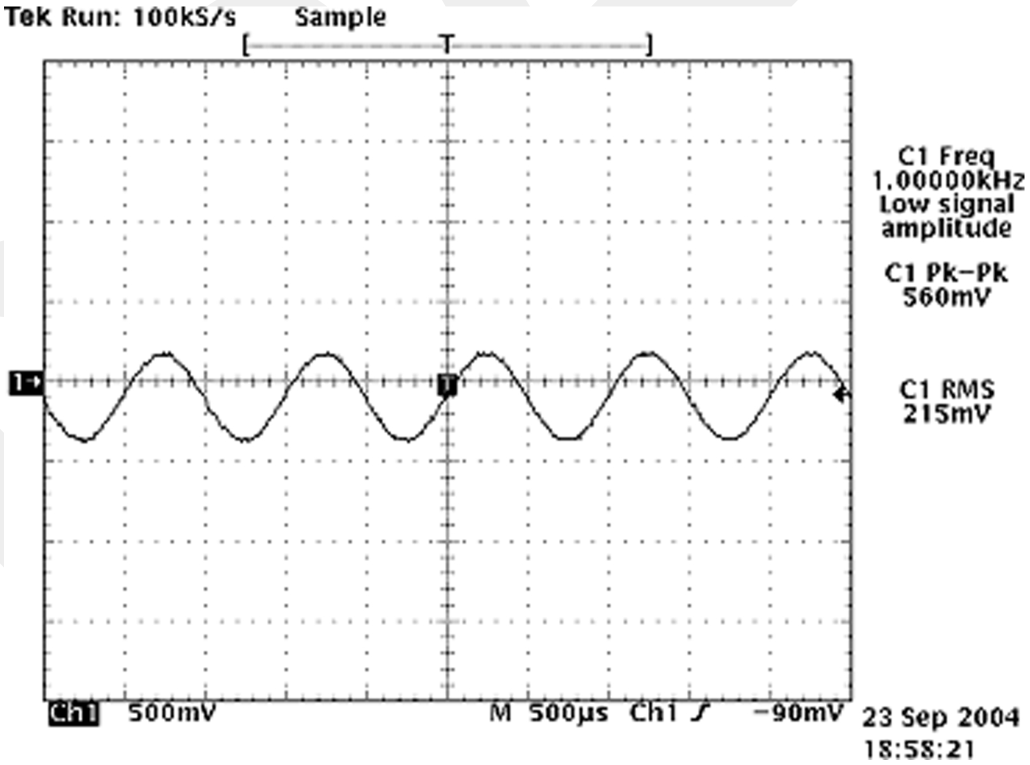


Figure 10 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 11 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

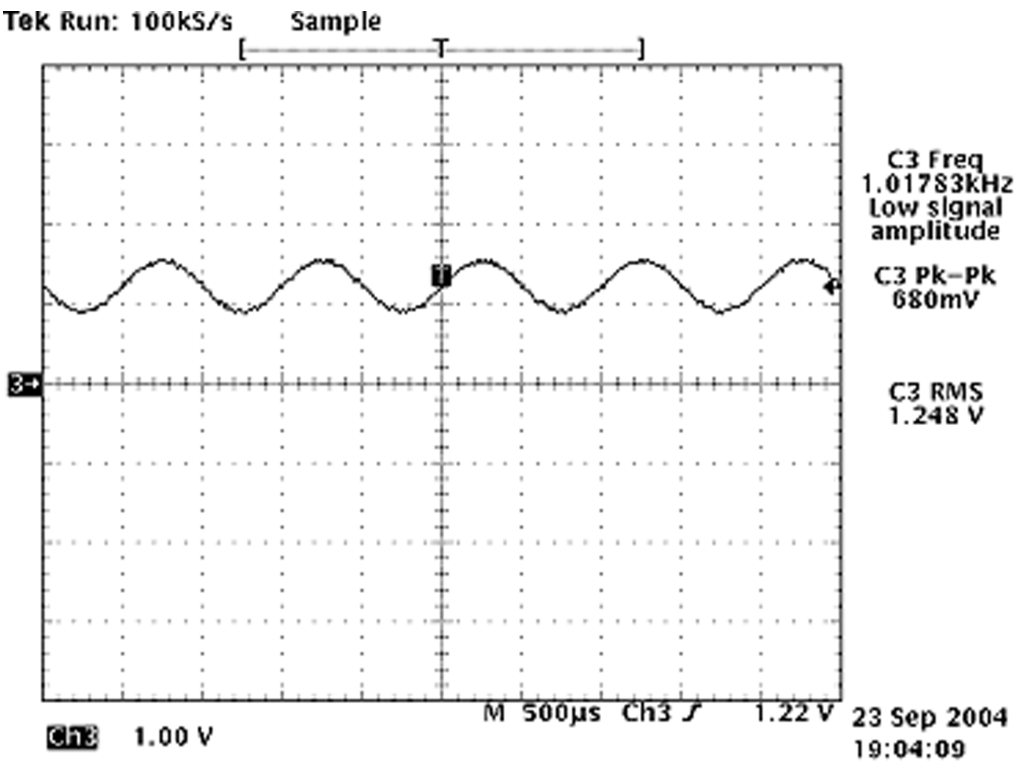


Figure 12 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

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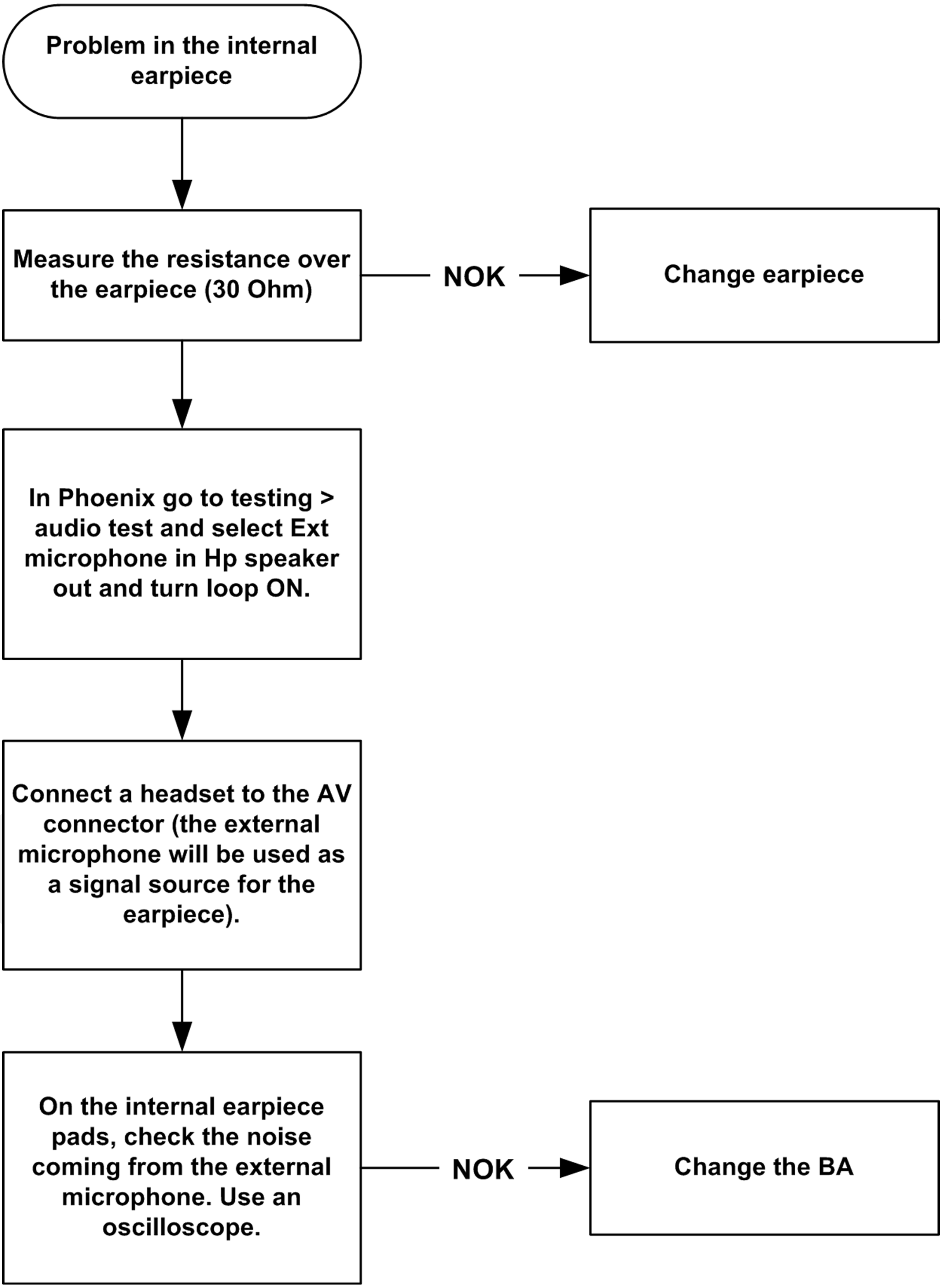
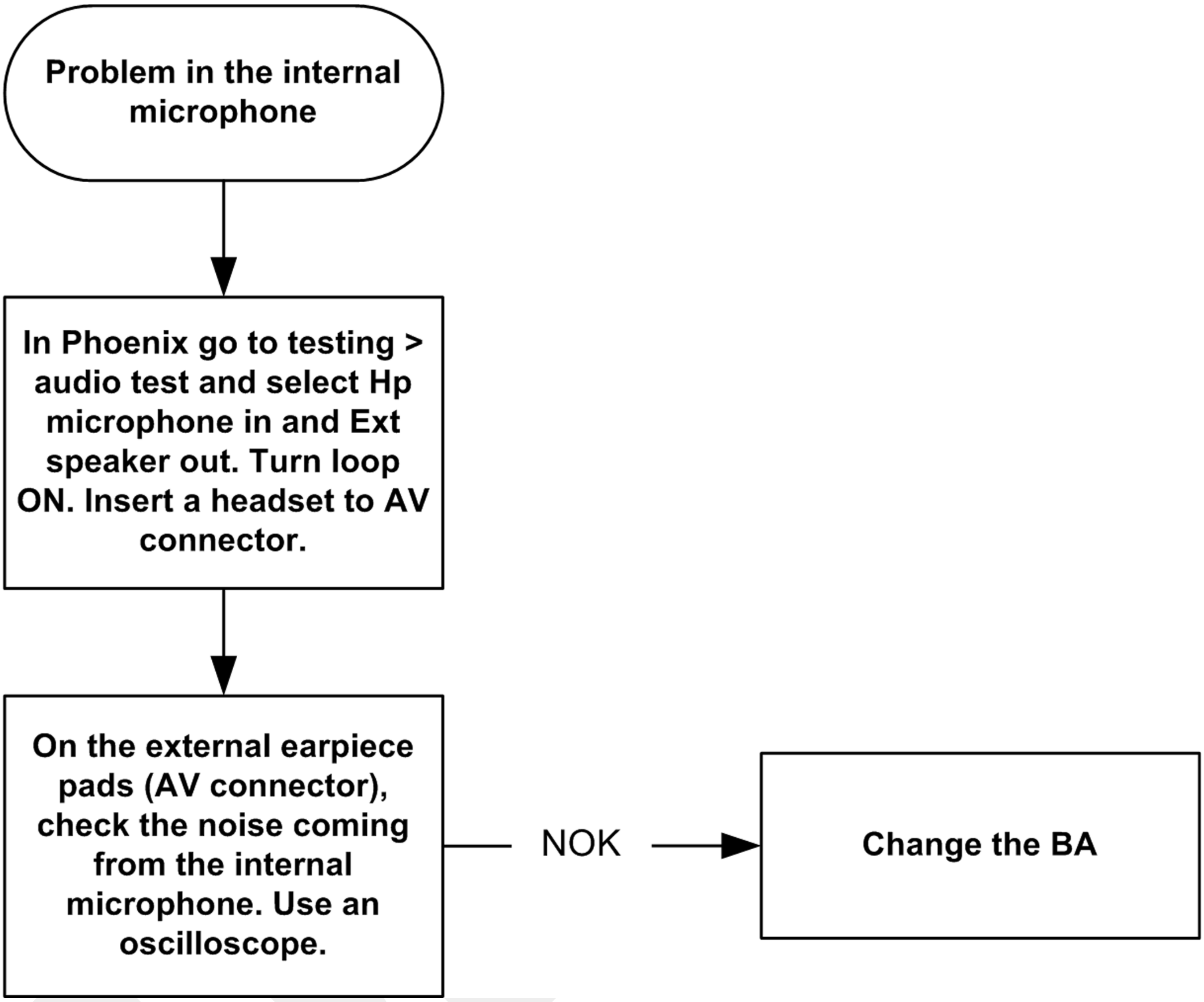
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the internal earpiece
Measure the resistance over the earpiece (30 Ohm)
NOK
Change earpiece
In Phoenix go to testing > audio test and select Ext microphone in Hp speaker out and turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the earpiece).
On the internal earpiece pads, check the noise coming from the external microphone. Use an oscilloscope.
NOK
Change the BA

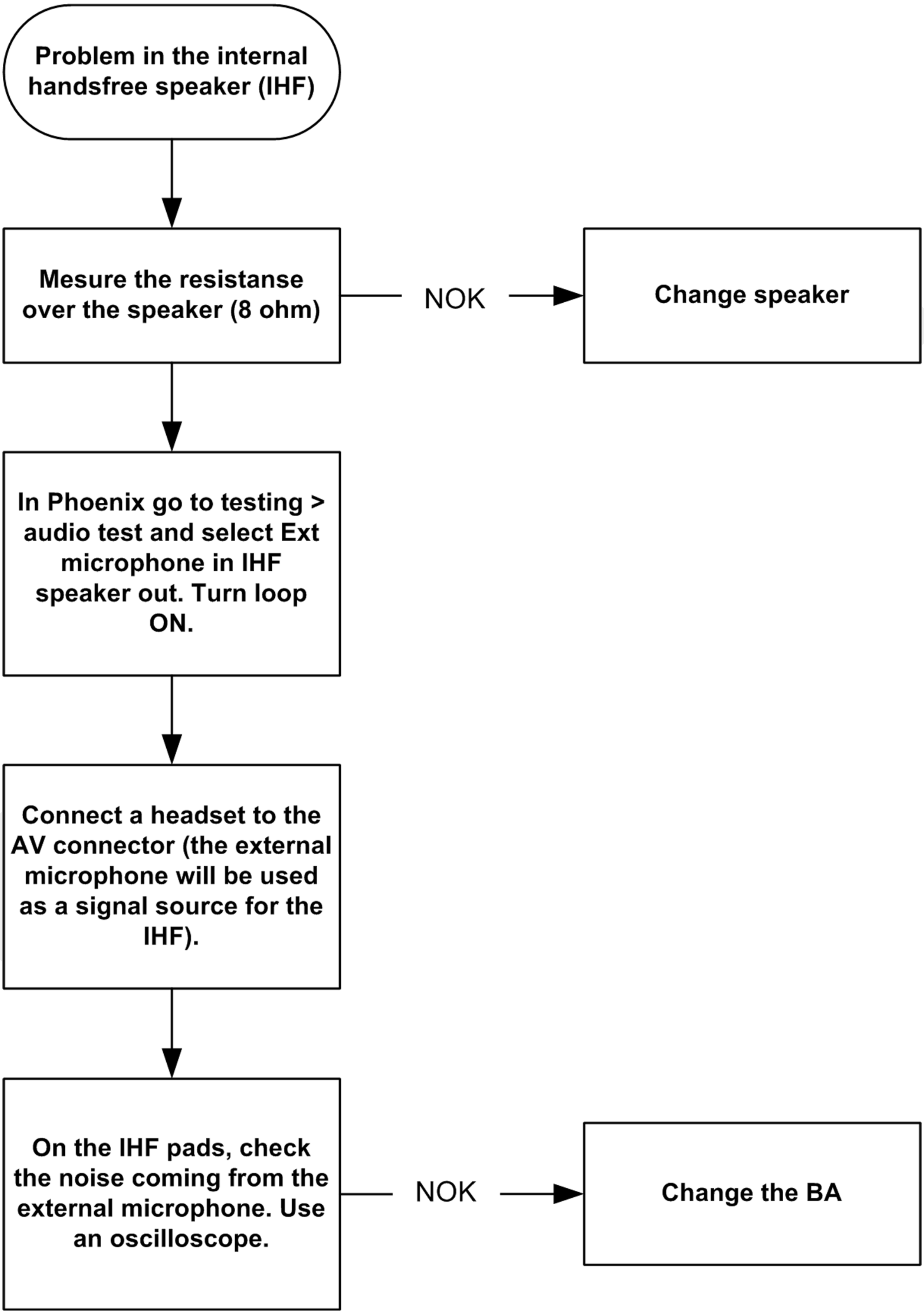
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone
In Phoenix go to testing > audio test and select Hp microphone in and Ext speaker out. Turn loop ON. Insert a headset to AV connector.
On the external earpiece pads (AV connector), check the noise coming from the internal microphone. Use an oscilloscope.
NOK
Change the BA

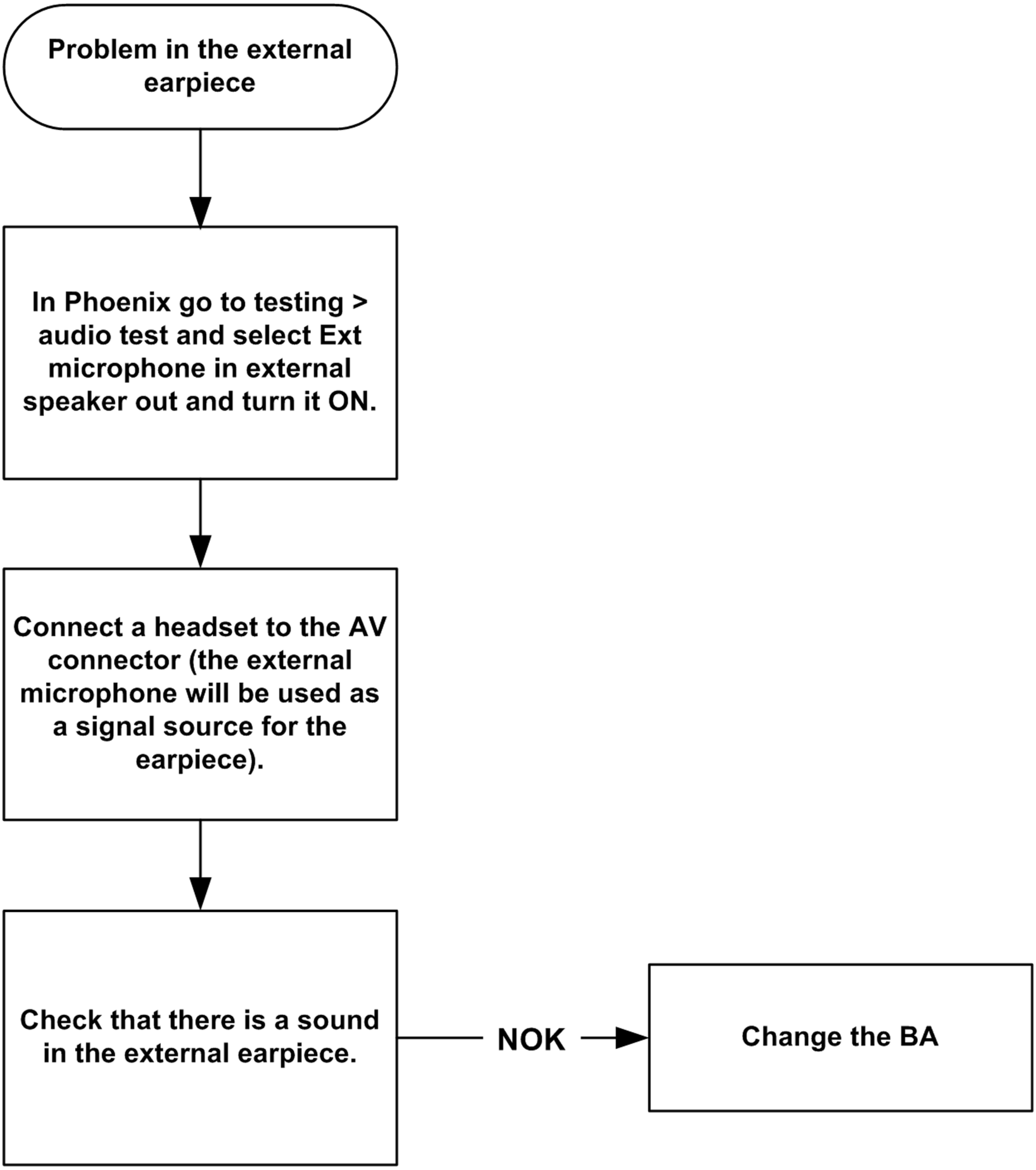
Internal handsfree (IHF) troubleshooting

Troubleshooting flow


Problem in the internal handsfree speaker (IHF)
Mesure the resistanse over the speaker (8 ohm)
NOK
Change speaker
In Phoenix go to testing > audio test and select Ext microphone in IHF speaker out. Turn loop ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the IHF).
On the IHF pads, check the noise coming from the external microphone. Use an oscilloscope.
NOK
Change the BA

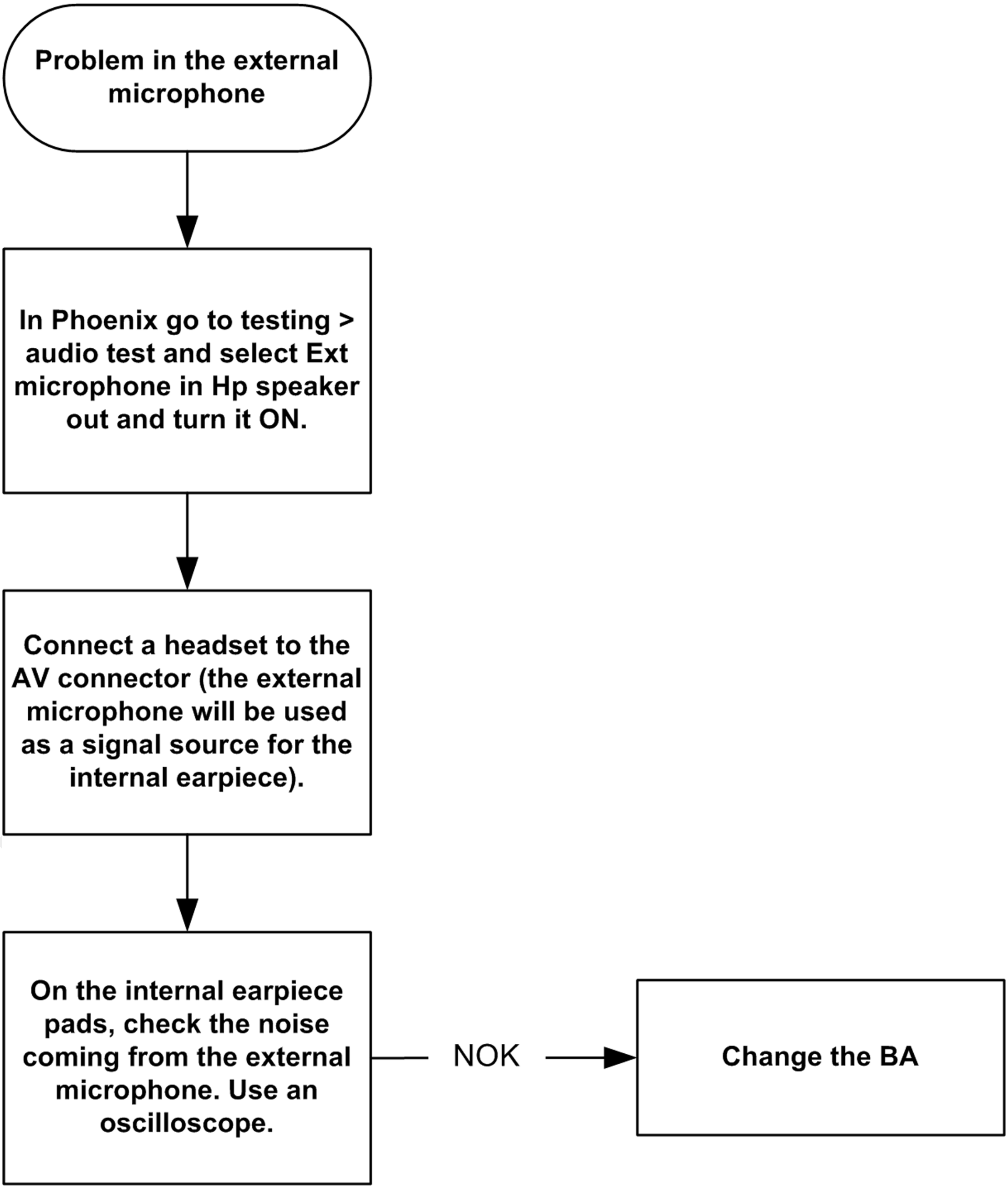
External earpiece troubleshooting

Troubleshooting flow


Problem in the external earpiece
In Phoenix go to testing > audio test and select Ext microphone in external speaker out and turn it ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the earpiece).
Check that there is a sound in the external earpiece.
NOK
Change the BA

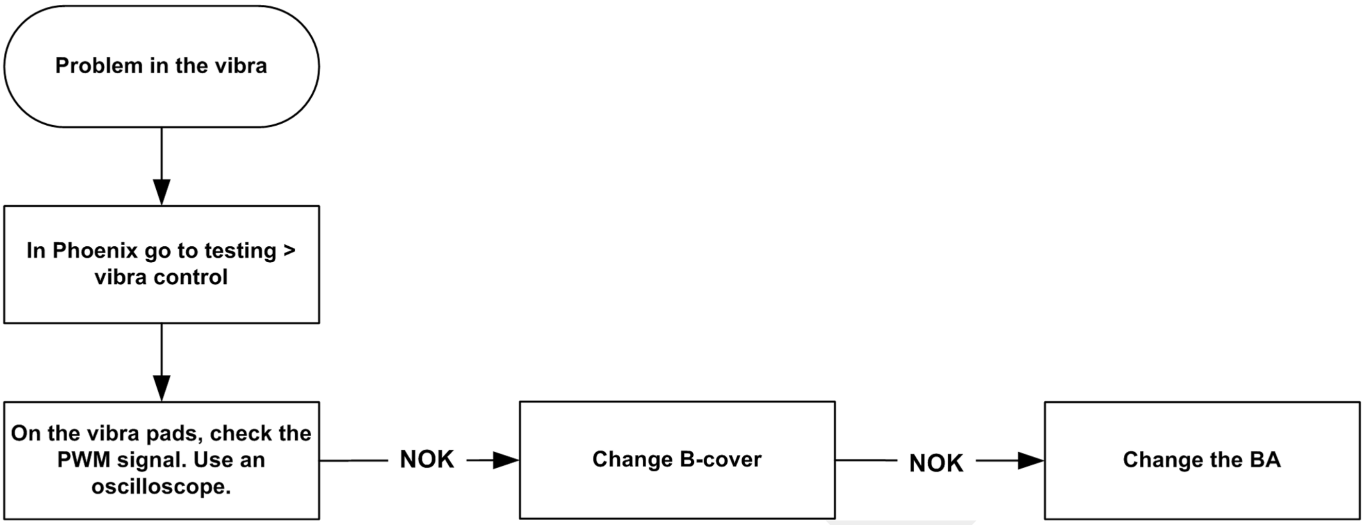
External microphone troubleshooting

Troubleshooting flow


Problem in the external microphone
In Phoenix go to testing > audio test and select Ext microphone in Hp speaker out and turn it ON.
Connect a headset to the AV connector (the external microphone will be used as a signal source for the internal earpiece).
On the internal earpiece pads, check the noise coming from the external microphone. Use an oscilloscope.
NOK
Change the BA

Vibra troubleshooting

Troubleshooting flow


Problem in the vibra
In Phoenix go to testing > vibra control
On the vibra pads, check the PWM signal. Use an oscilloscope.
NOK
Change B-cover
NOK
Change the BA

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.

- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.

- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2008.4 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)

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- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

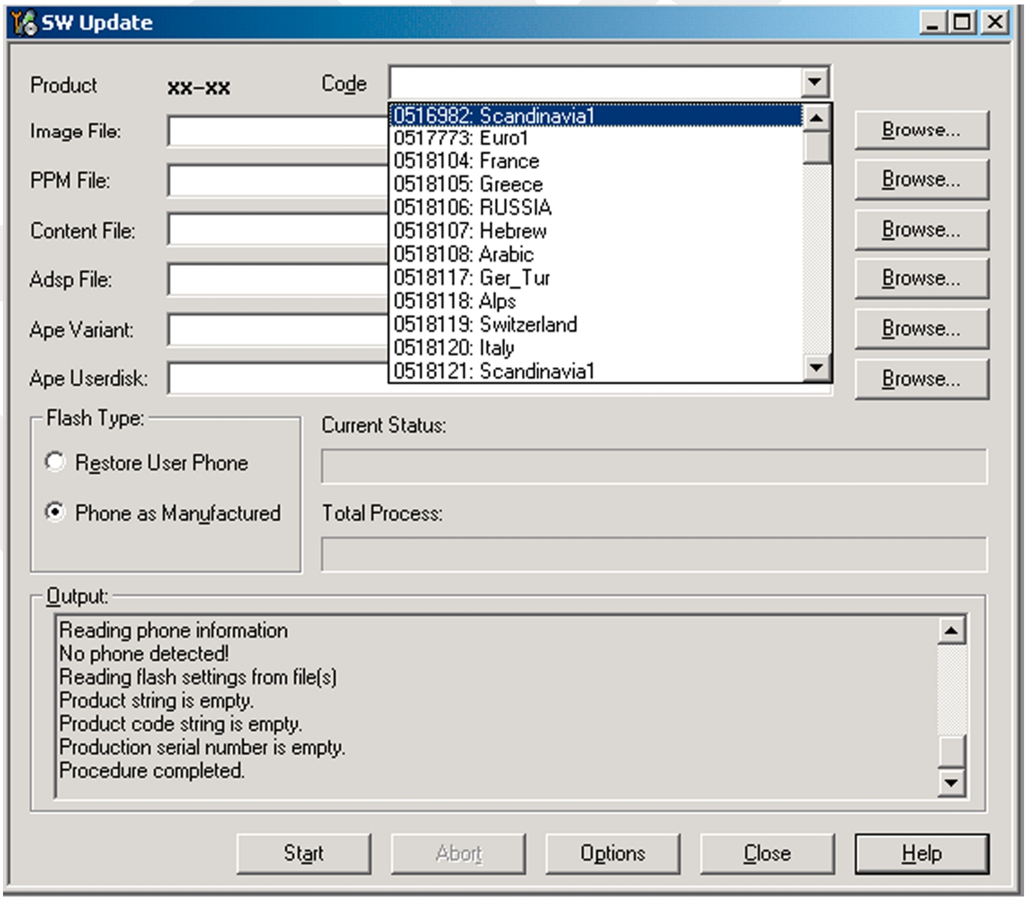
  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
   - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   - ii Update the phone MCU software to the latest available version.

     If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   - iii Choose the product manually from **File→Open Product** , and click **OK**.

     Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   - iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.


SW Update
Product
Code
0516982: Scandinavia1
0517773: Euro1
0518104: France
0518105: Greece
0518106: RUSSIA
0518107: Hebrew
0518108: Arabic
0518117: Ger_Tur
0518118: Alps
0518119: Switzerland
0518120: Italy
0518121: Scandinavia1
Image File:
PPM File:
Content File:
Adsp File:
Ape Variant:
Ape Userdisk:
Browse...
Browse...
Browse...
Browse...
Browse...
Browse...
Flash Type:
Restore User Phone
Current Status:
Total Process:
Output:
Start
Abort
Options
Close
Help

Product: XX-XX

Flash Type: ● Phone as Manufactured

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

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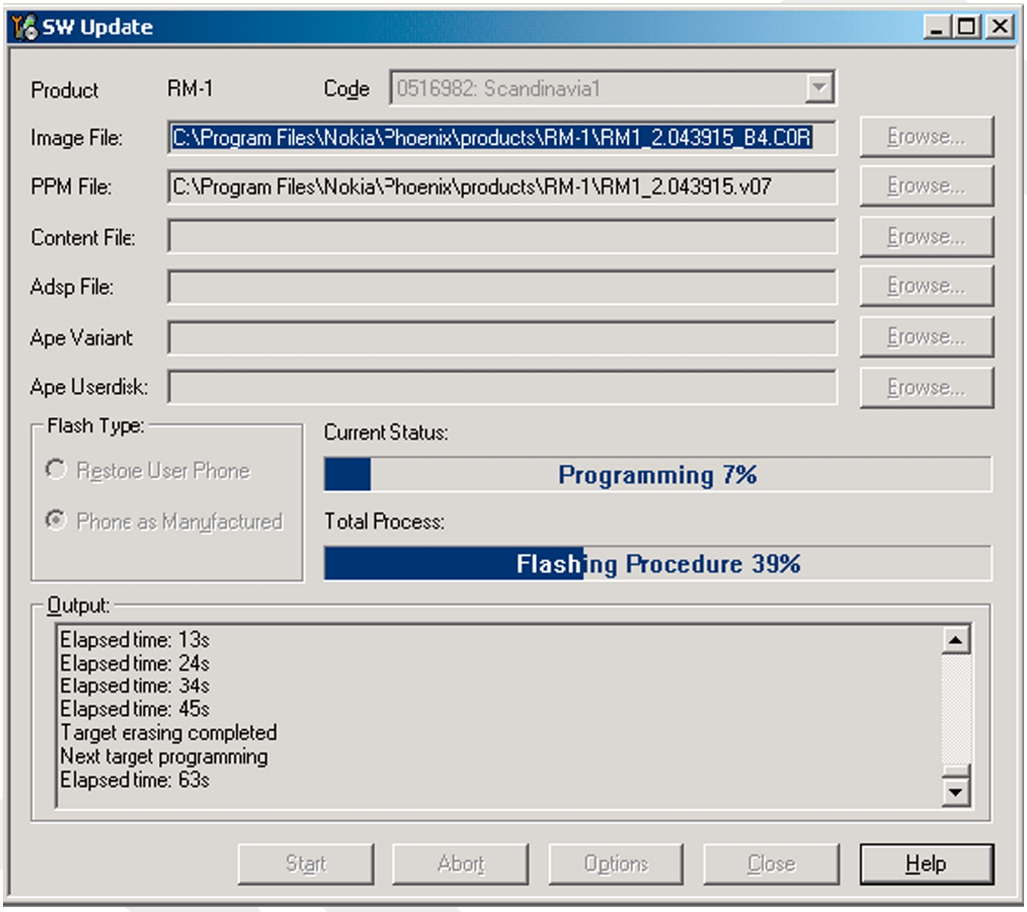
Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.



Product RM-1

Code 0516982: Scandinavia1

Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R

PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07

Content File:

Adsp File:

Ape Variant

Ape Userdisk:

● Phone as Manufactured

Current Status: Programming 7%

Total Process: Flashing Procedure 39%

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

Programming is completed when Flashing Completed message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

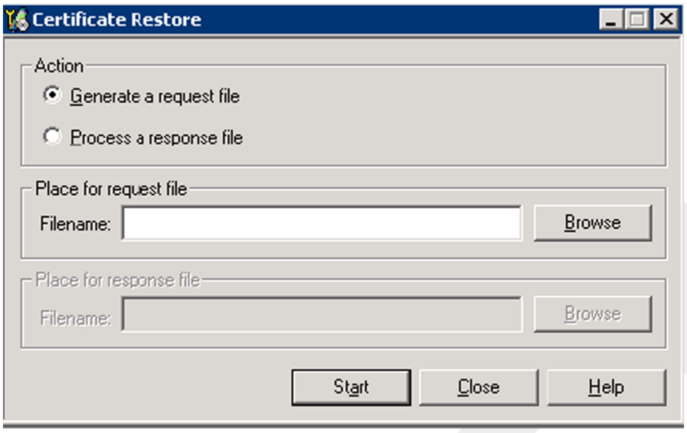
2. Create a *Request* file.

   For this procedure, you must supply +12 V to CU-4 from an external power supply.

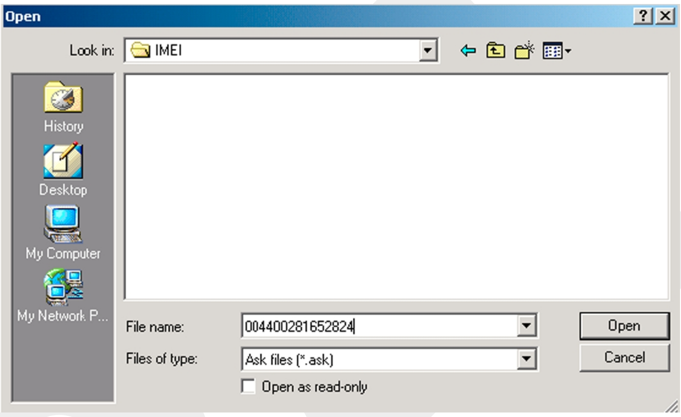
   i To connect the phone with *Phoenix*, choose **File→Scan Product** .

   ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.


Certificate Restore
Action
● Generate a request file
○ Process a response file
Place for request file
Filename:
Browse
Place for response file
Filename:
Browse
Start
Close
Help

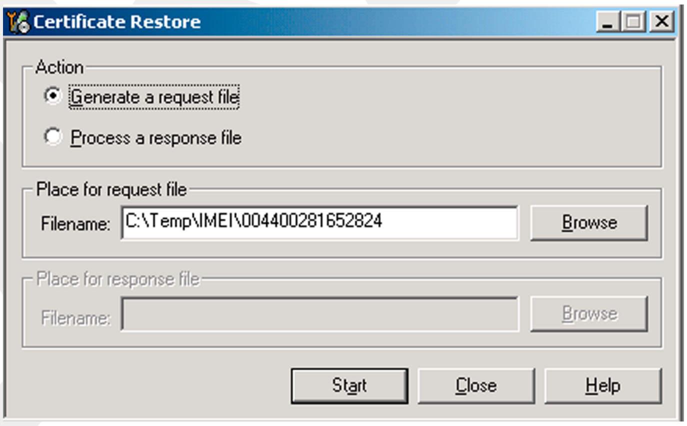
iv Name the file so that you can easily identify it, and click **Open**.


Open
Look in:
IMEI
History
Desktop
My Computer
My Network P...
Open
Cancel
☐ Open as read-only

File name: 004400281652824

Files of type: Ask files (*.ask)

The name of the file and its location are shown.


Certificate Restore
Action
● Generate a request file
○ Process a response file
Place for request file
Browse
Place for response file
Filename:
Browse
Start
Close
Help

Filename: C:\Temp\IMEI\004400281652824

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

   For this procedure, you must supply +12 V to CU-4 from an external power supply.

   i Save the reply file sent by Nokia to your computer.

   ii Start *Phoenix* service software.

   iii Choose **File→Scan Product** .

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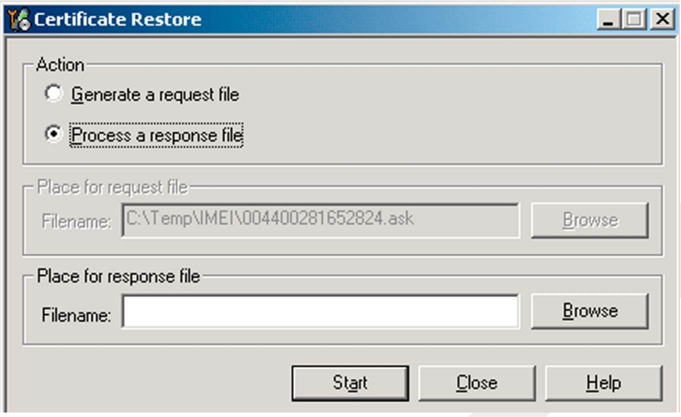
iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.


Certificate Restore
Browse
Browse
Start
Close
Help

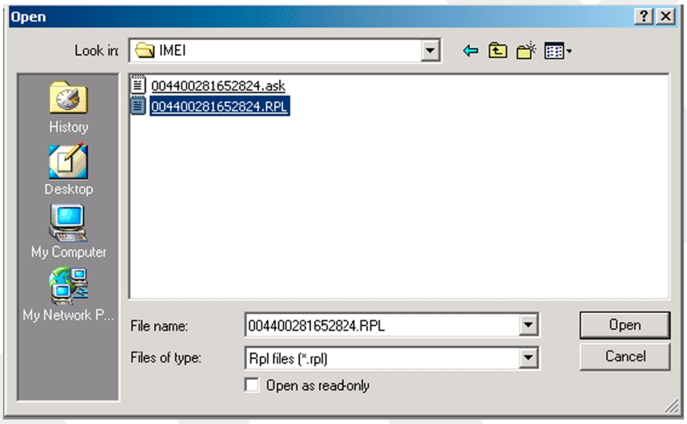
Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

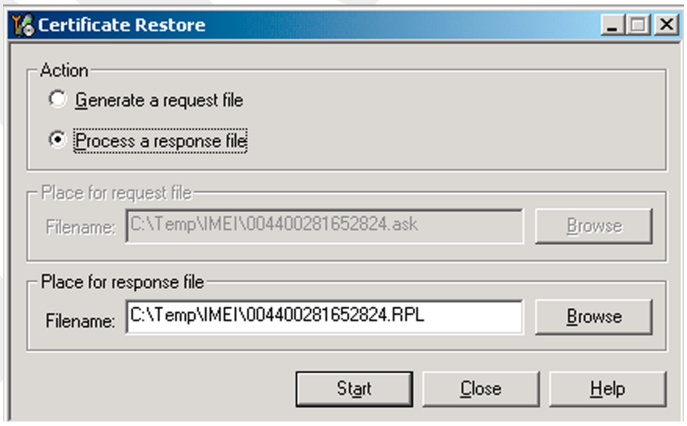
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.


Certificate Restore
Browse
Browse
Start
Close
Help

Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

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Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 6 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

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4 — RF troubleshooting

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General RF troubleshooting

Introduction to RF troubleshooting

Troubleshooting process

RF troubleshooting is performed in this order:

1. Autotuning
2. General power checking
3. Selftests
4. RX and TX troubleshootings

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N1001
- Front End Module (FEM) N1002

Discrete components

In addition to the two key-components, there are few number of discrete components (capacitors and inductors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Please refer to the troubleshooting instructions for further information.

RF key components

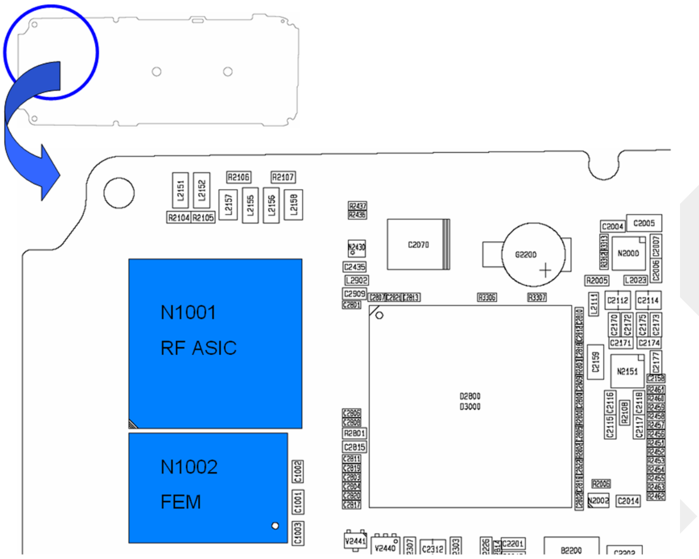
N1001
RF ASIC
N1002
FEM
C2070
G2200
N2000
N2151
D2800
D3000

Figure 13 RF key components

Auto tuning for RF

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

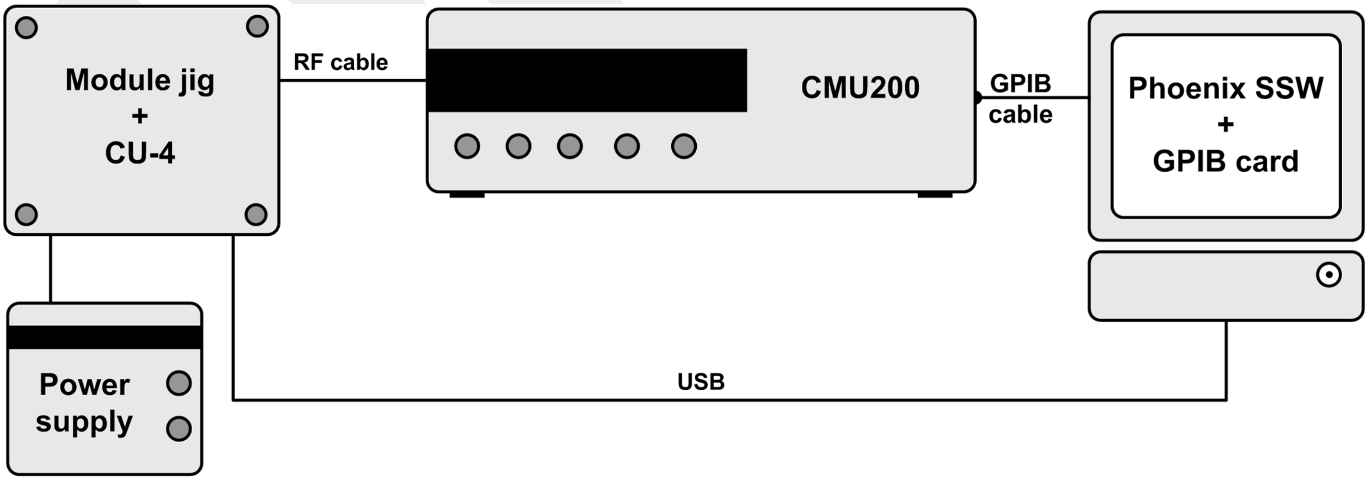
Module jig
+
CU-4
RF cable
CMU200
GPIB
cable
Phoenix SSW
+
GPIB card
Power
supply
USB

Figure 14 Auto tuning concept with CMU200

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Phoenix preparations

Install the phone specific data package, for example *RM-378/379_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings..

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.
3 Start autotuning, clicking the *Tune* button.

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	Vbat at N1002 (FEM)	J2903	3.0-4.7 V
2	Vbat at N1001 (Transceiver)	C1002	3.0-4.7 V
3	VCCXO supply	C2213	2.4-2.6 V

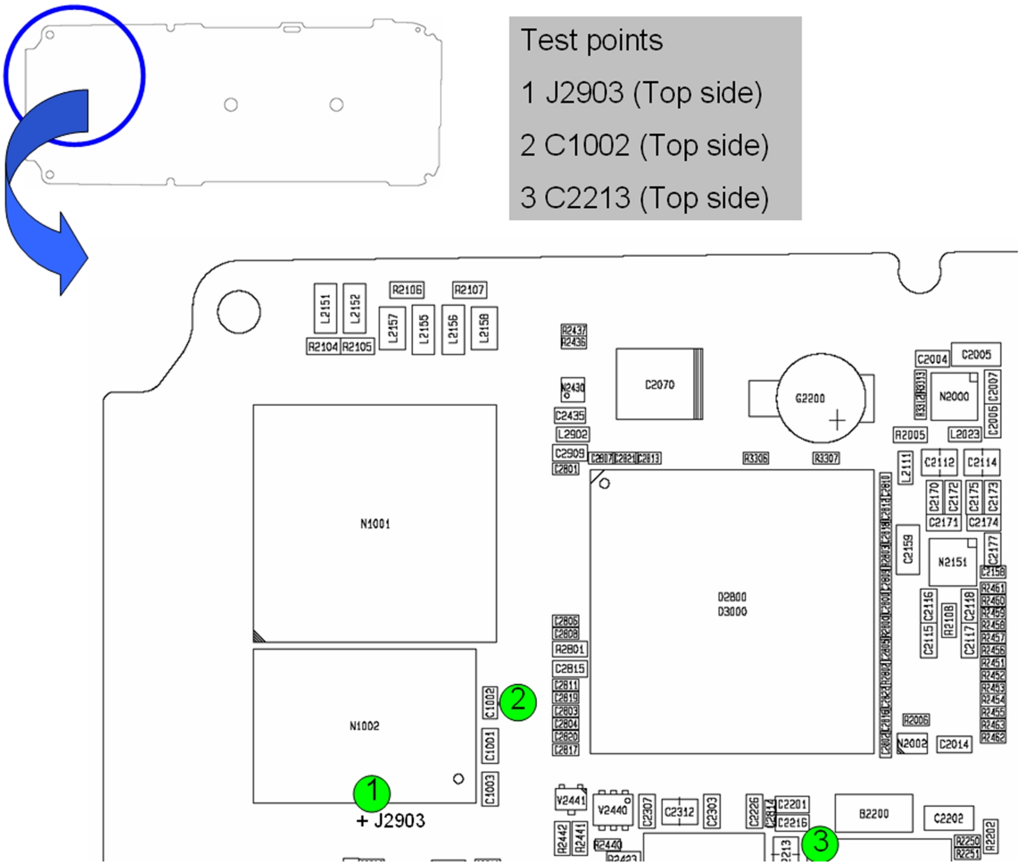
Test points
1 J2903 (Top side)
2 C1002 (Top side)
3 C2213 (Top side)
N1001
N1002
D2800
D3000
C2070
G2200
N2000
N2151
B2200
+ J2903
1
2
3

Figure 15 General voltage checking test points (main board, both sides)

Selftest troubleshooting

RF selftests

Prerequisites

Do a hardware initialization before you start the selftests:

Testing→**GSM**→**RF Controls**→ **RX** and then press **Stop**.

Context

Note: The RF connector should be terminated to 50 Ohms or connected to the antenna. Check this carefully before performing the self tests.

Note: The phone should be in **local mode** when performing Self tests

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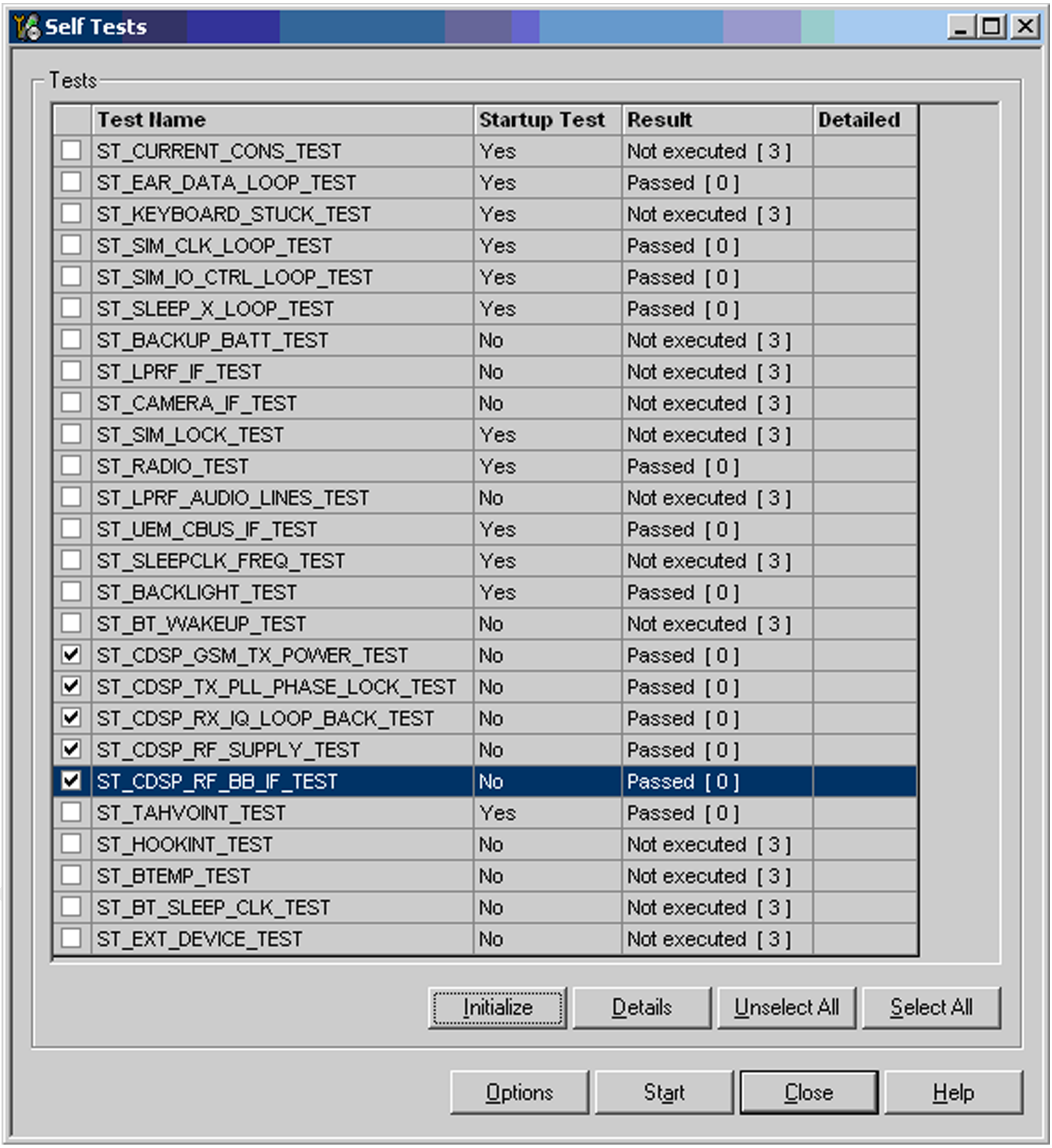
Steps

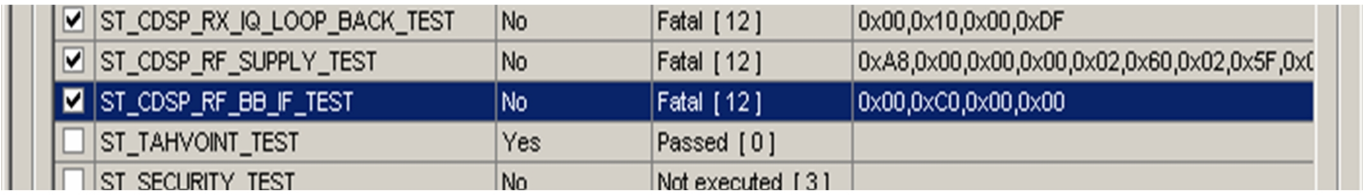
1. Check the tests shown in the figure below: **Testing**→ **Self Tests** , and press the **Start** button.



	Test Name	Startup Test	Result	Detailed
☐	ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	Yes	Not executed [3]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_SLEEP_X_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	No	Not executed [3]	
☐	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☐	ST_RADIO_TEST	Yes	Passed [0]	
☐	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Not executed [3]	
☐	ST_BACKLIGHT_TEST	Yes	Passed [0]	
☐	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☑	ST_CDSP_GSM_TX_POWER_TEST	No	Passed [0]	
☑	ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Passed [0]	
☑	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Passed [0]	
☑	ST_CDSP_RF_SUPPLY_TEST	No	Passed [0]	
☑	ST_CDSP_RF_BB_IF_TEST	No	Passed [0]	
☐	ST_TAHVOINT_TEST	Yes	Passed [0]	
☐	ST_HOOKINT_TEST	No	Not executed [3]	
☐	ST_BTEMP_TEST	No	Not executed [3]	
☐	ST_BT_SLEEP_CLK_TEST	No	Not executed [3]	
☐	ST_EXT_DEVICE_TEST	No	Not executed [3]	

2. A test is either Passed or Fatal. If **Fatal** continue the selftest troubleshooting. If **Passed** continue with the other RF troubleshootings.
3. If Fatal, press **Details** to see error codes

   Error codes will now show up in the right most column marked *Detailed*.



☑	ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Fatal [12]	0x00,0x10,0x00,0xDF
☑	ST_CDSP_RF_SUPPLY_TEST	No	Fatal [12]	0xA8,0x00,0x00,0x00,0x02,0x60,0x02,0x5F,0x
☑	ST_CDSP_RF_BB_IF_TEST	No	Fatal [12]	0x00,0xC0,0x00,0x00
☐	ST_TAHVOINT_TEST	Yes	Passed [0]	
☐	ST_SECURITY_TEST	No	Not executed [3]	

Note: The Error Code contains the two first words: *0x00* and *0xC0*.

Fatal selftests troubleshooting

If a self test is fatal, check the **Details→Error code** and follow the instructions below.

Note: If **ST_CDSP_RF_BB_IF_TEST** is fatal, the other self tests will also be fatal. Always start troubleshooting ST_CDSP_RF_BB_IF_TEST.

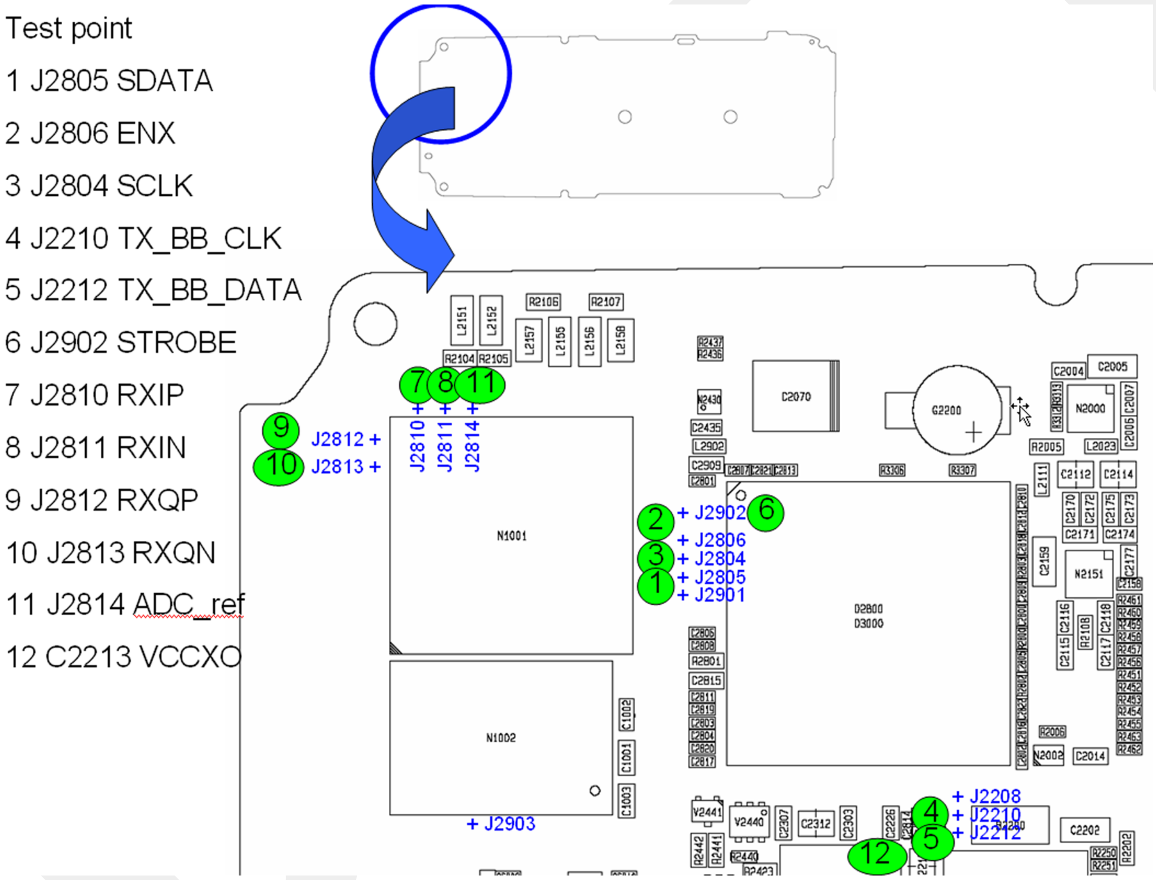
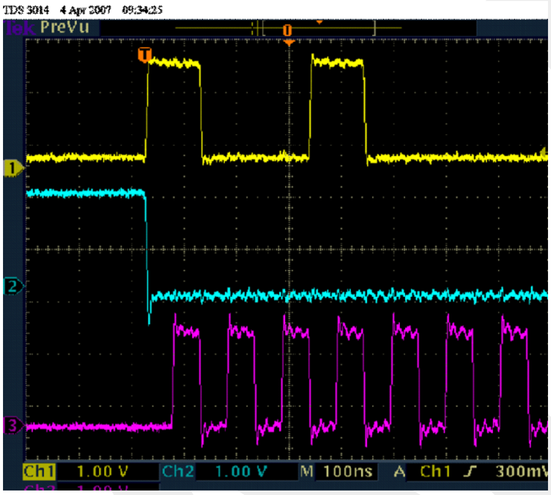
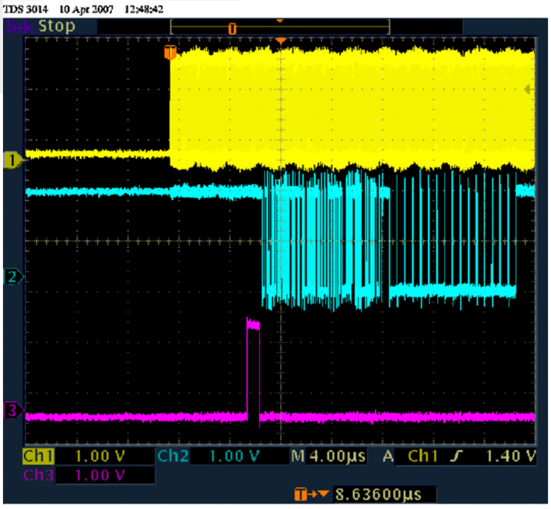

Test point
1 J2805 SDATA
2 J2806 ENX
3 J2804 SCLK
4 J2210 TX_BB_CLK
5 J2212 TX_BB_DATA
6 J2902 STROBE
7 J2810 RXIP
8 J2811 RXIN
9 J2812 RXQP
10 J2813 RXQN
11 J2814 ADC_ref
12 C2213 VCCXO
J2812
J2813
J2810
J2811
J2814
J2902
J2806
J2804
J2805
J2901
J2903
J2208
J2210
J2212
N1001
N1002
D2800
D3000
G2200
C2070
N2000
N2151

Figure 16 Testpoints used after fatal self tests

ST_CDSP_RF_BB_IF_TEST is fatal

This test is checking the communication between baseband and RF. It will show in what part the problem is located.

Error code	Test	Action
ST_RFBUS_WRITE_READ_FAIL (0x00, 0x40) or combination (0x00, 0xC0)	In Phoenix **Testing**→ **GSM**→ **RF Controls**→**RX** Probe: 1 J2805 SDATA (Ch1) [1] 2 J2806 ENX (Ch2) [2] 3 J2804 SCLK (Ch3) [3] The **result** should look like this:  TDS 3014 4 Apr 2007 09:34:25 Tek PreVu Ch1 1.00 V Ch2 1.00 V M 100ns A Ch1 ∫ 300mV **Figure 17 Settings: Time 1ns/d + 0.1Vpp/d**	**All OK**: replace N1001 **NOK** : go to BB troubleshooting
ST_TXFIFO_WRITE_READ_FAIL (0x00, 0x80)	In Phoenix: **Testing**→ **GSM**→ **RF Controls**→**TX** Probe: 1 J2210 TXBB_CLK (Ch1) [4] 2 J2212 TXBB_DATA (Ch2) [5] 3 J2902 STROBE (Ch3) [6] The **result** should look like this:  TDS 3014 10 Apr 2007 12:48:42 Tek Stop Ch1 1.00 V Ch2 1.00 V M 4.00µs A Ch1 ∫ 1.40 V Ch3 1.00 V 8.63600µs **Figure 18 Settings: Time 1ns/d + 0.3Vpp/d**	**All OK**: replace N1001 **NOK** : go to BB troubleshooting

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ST_CDSP_GSM_TX_POWER_TEST is fatal

This test is checking power amplifier functionality.

Error code	Test	Action
ST_GSM1800_TX_PWR_LOW (0x00, 0x02) ST_GSM850_TX_PWR_LOW (0x00, 0x08) Or combination (0x00, 0x0A)	-	Replace N1002
ST_TXDAC_FAIL (0x00, 0x10) Or combination (0x00, 0x1A), (0x00, 0x12), (0x00, 0x18)	-	Replace N1001

ST_CDSP_TX_PLL_PHASE_LOCK_TEST is fatal

This test is checking if phase lock loop is working.

Error code	Test	Action
ST_TX_PLL_FAIL (0x00, 0x08)		Replace N1001

ST_CDSP_RX_IQ_LOOP_BACK_TEST is fatal

This test is checking the analogue RX communication between baseband and RF.

Error code	Test	Action
ST_FIMRCAL_FAIL (0x00, 0x40) or combination (0x00, 0x50) and (0x00, 0x60)		Replace N1001

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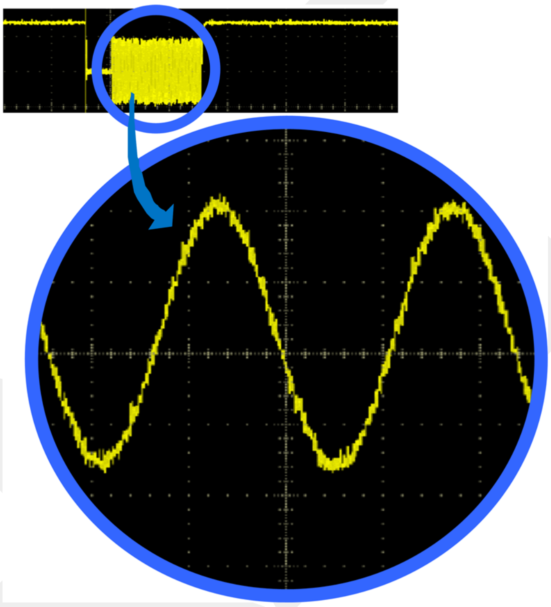
Error code	Test	Action
ST_IQ_POWER_TOO_SMALL (0x00, 0x10) ST_IQ_POWER_TOO_HIGH (0x00, 0x20)	In Phoenix: **Testing**→ **GSM**→ **RF Controls**→**RX** Apply -80dBm signal at 948.06771 MHz Probe during RX operation: 1 J2810 RXIP [7] 2 J2811 RXIN [8] 3 J2812 RXQP (Ch1) [9] 4 J2813 RXQN [10] 5 J2814 ADC_ref [11] Check voltage level between 0.7-0.8V The **result** should look like this:  **Figure 19 Frequency ~ 100kHz**	**All OK** : go to BB troubleshooting **NOK**: replace N1001

ST_CDSP_RF_SUPPLY_TEST is fatal

This test is checking internal voltage regulators.

Error code	Test	Action
ST_VREG_LDO2 (0x20, 0x00) ST_VREG_VCCXO (0x80, 0x00) Or combination (0xA0, 0x00)	Check 1 VCCXO value at testpoint C2213 = 2 .4 – 2.6 V [12] 2 VBat = 3.0 – 4.7 V	**All OK**: replace N1001 **NOK** : go to power troubleshooting

Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*.

GSM RX chain activation for manual measurements/GSM RSSI measurement

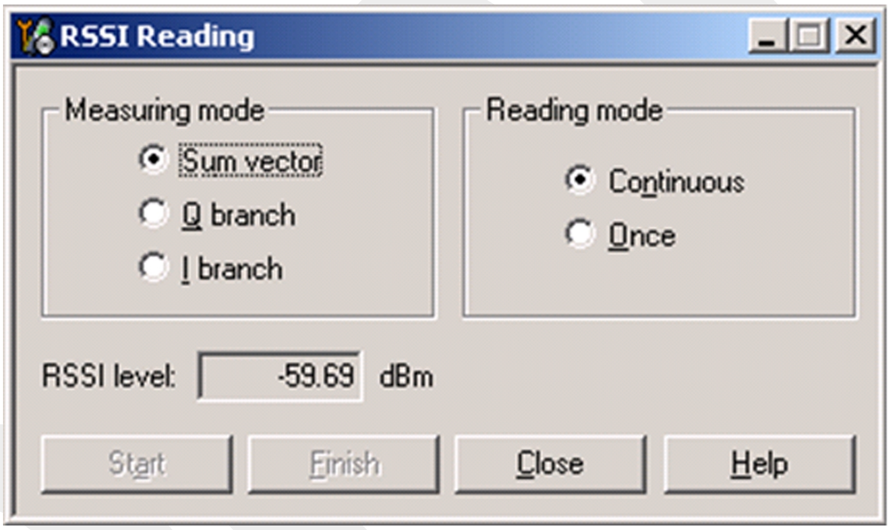
Prerequisites

Make the following settings in Phoenix service software and in the signal generator:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771 MHz (67.71kHz offset) at -60dBm	942.46771 MHz (67.71kHz offset) at -60dBm	1842.86771 MHz (67.71kHz offset) at -60dBm	1960.06771 MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



RSSI Reading

Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

Results

With the *Measuring mode* set to *Sum vector*, the reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

Now select the measuring mode to *Q branch* and *I Branch*. In each case the reading should be 3 dB below the signal generator level.

Next actions

RSSI-reading AND TX troubleshooting is failing: replace N1002.

TX is OK and RX is failing: replace N1001.

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Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

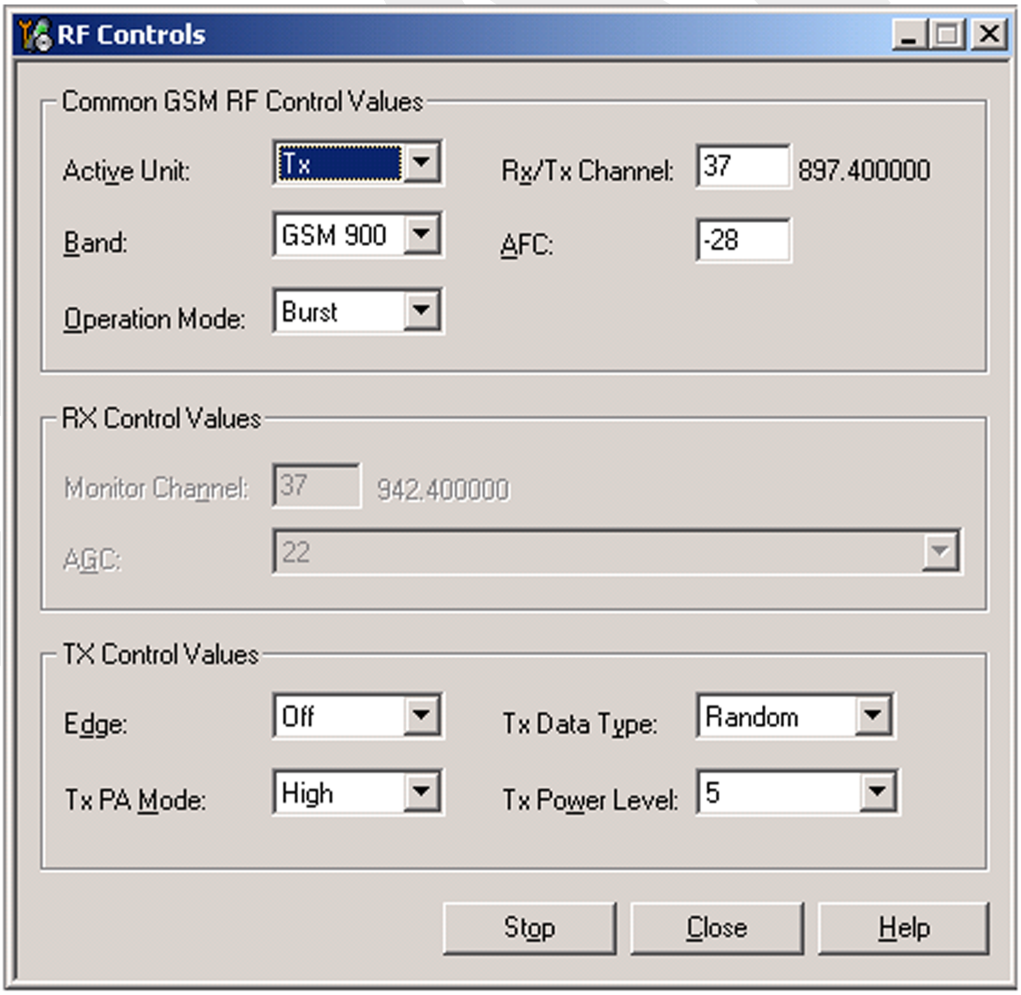
> **Note:** Never activate the GSM transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the power amplifier may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

   Make settings as shown in the picture:



Common GSM RF Control Values

Active Unit: Tx

Band: GSM 900

Operation Mode: Burst

Rx/Tx Channel: 37 897.400000

AFC: -28

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx PA Mode: High

Tx Data Type: Random

Tx Power Level: 5

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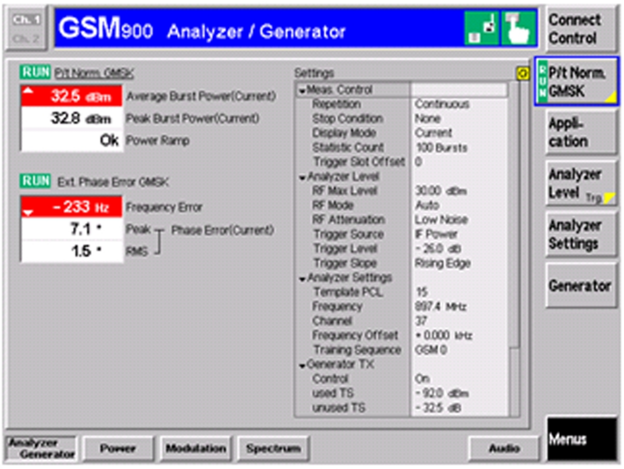
3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings


Ch. 1
Ch. 2
Connect Control
P/t Norm. GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM900 Analyzer / Generator

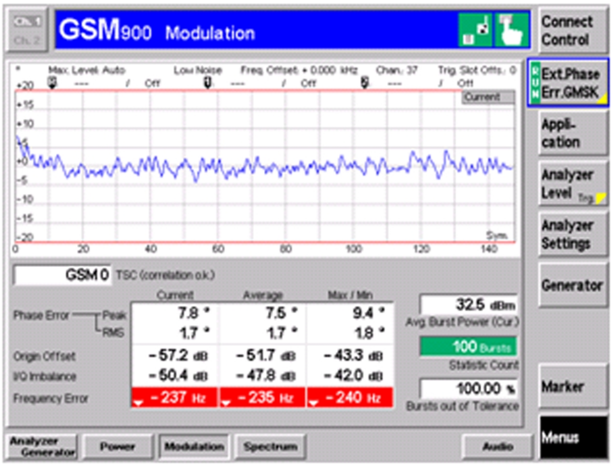
RUN P/t Norm. GMSK
32.5 dBm Average Burst Power(Current)
32.8 dBm Peak Burst Power(Current)
Ok Power Ramp

RUN Ext. Phase Error GMSK
-233 Hz Frequency Error
7.1 ° Peak Phase Error(Current)
1.5 ° RMS

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	-26.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	On
used TS	-92.0 dBm
unused TS	-32.5 dB

Phase error


Ch. 1
Ch. 2
Connect Control
Ext.Phase Err.GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+20
+15
+10
+5
+0
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

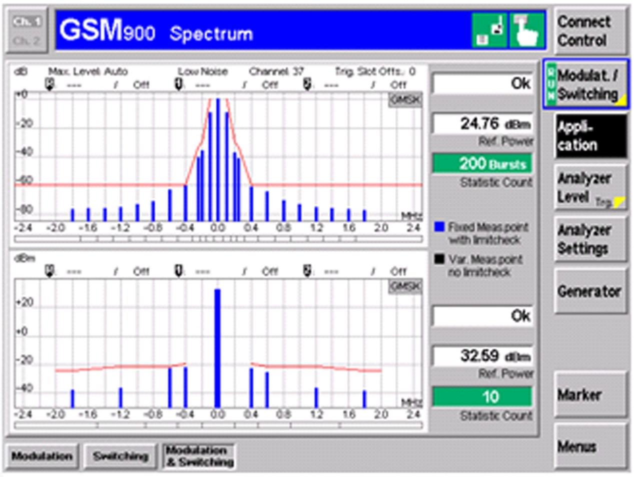
GSM900 Modulation

GSM 0 TSC (correlation o.k.)

		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		-57.2 dB	-51.7 dB	-43.3 dB
I/Q Imbalance		-50.4 dB	-47.8 dB	-42.0 dB
Frequency Error		-237 Hz	-235 Hz	-240 Hz

32.5 dBm Avg. Burst Power (Cur.)
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

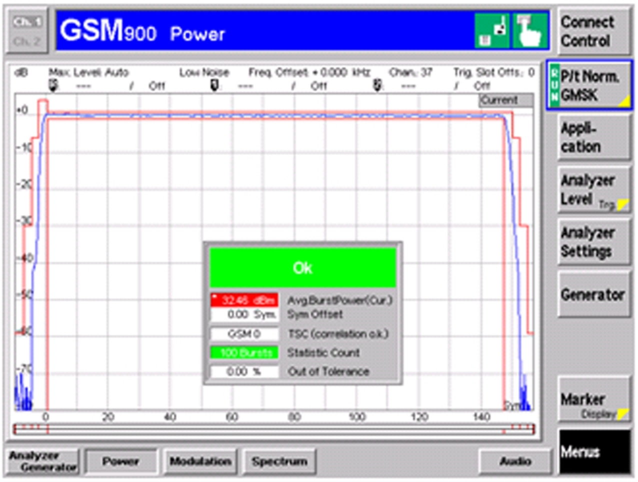
Modulation/Switching spectrum


Ch. 1
Ch. 2
Connect Control
Modulat. / Switching
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
dB
Max. Level: Auto
Low Noise
Channel: 37
Trig. Slot Offs.: 0
Off
GMSK
dBm
+0
-20
-40
-60
-80
+20
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
Modulation
Switching
Modulation & Switching

GSM900 Spectrum

Ok
24.76 dBm Ref. Power
200 Bursts Statistic Count
Fixed Meas.point with limitcheck
Var. Meas.point no limitcheck
Ok
32.59 dBm Ref. Power
10 Statistic Count

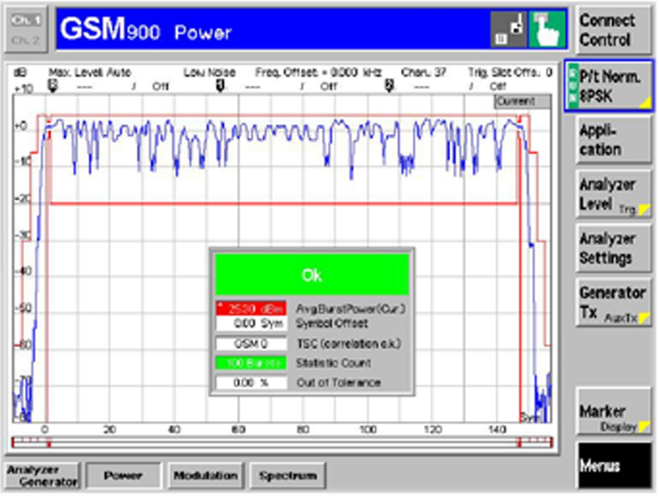
Power/Burst


Ch. 1
Ch. 2
Connect Control
P/t Norm. GMSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM900 Power

Ok
32.46 dBm Avg.BurstPower(Cur.)
0.00 Sym. Sym Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Edge


Ch. 1
Ch. 2
Connect Control
P/t Norm. 8PSK
Appli- cation
Analyzer Level Trg
Analyzer Settings
Generator Tx AuxTx
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: +0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+10
+0
-10
-20
-30
-40
-50
-60
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum

GSM900 Power

Ok
25.30 dBm AvgBurstPower(Cur.)
0.00 Sym Symbol Offset
GSM 0 TSC (correlation o.k.)
100 Bursts Statistic Count
0.00 % Out of Tolerance

Figure 20 Typical readings

4. Change power level (RF controls) and make sure the power reading follows accordingly.

Next actions

TX is failing and RX is OK: replace N1002

If you want to troubleshoot the other bands, change band with RF controls and set the communication analyzer accordingly.

Bluetooth and FM radio troubleshooting

Bluetooth troubleshooting

Troubleshooting flow

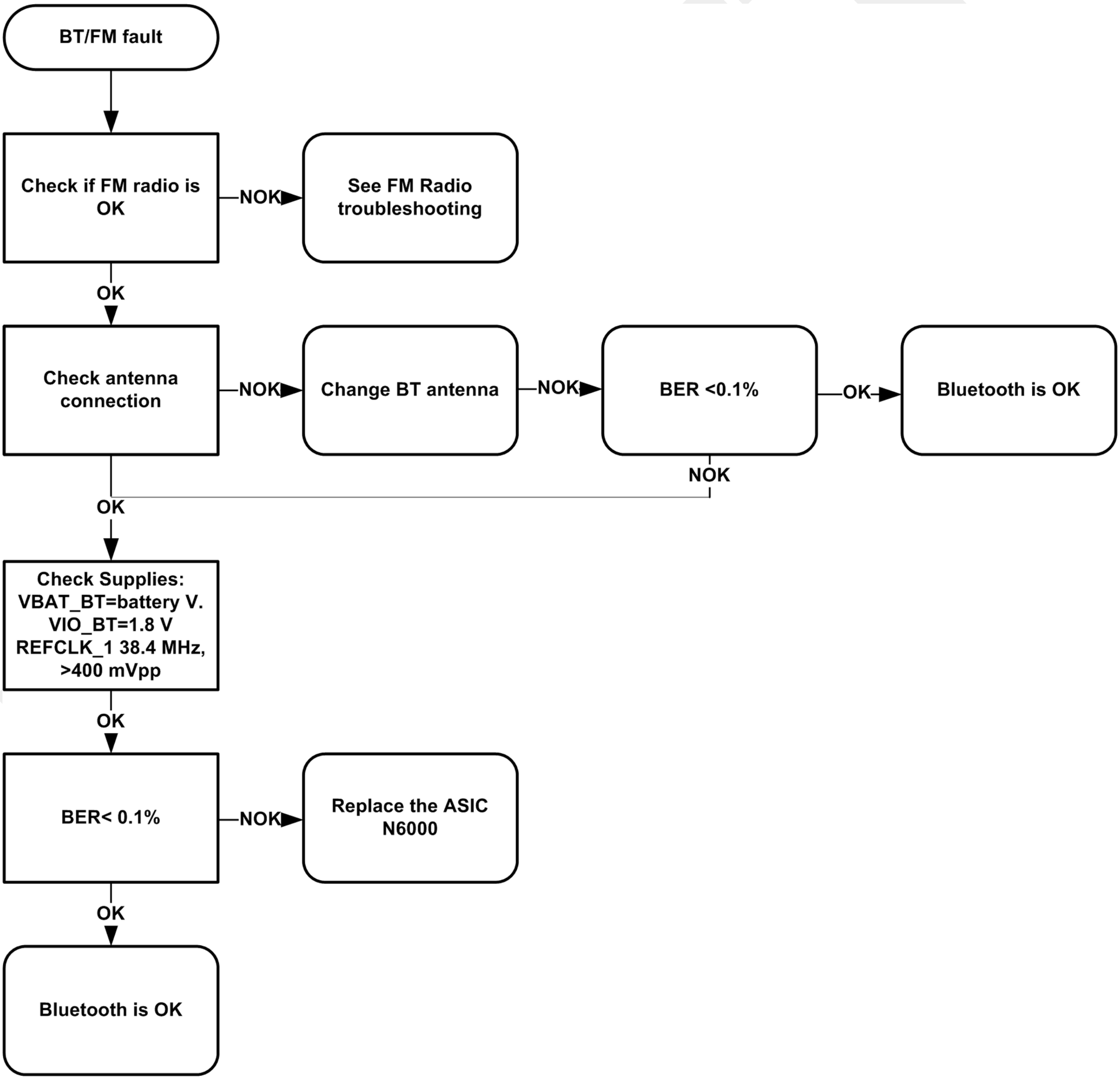
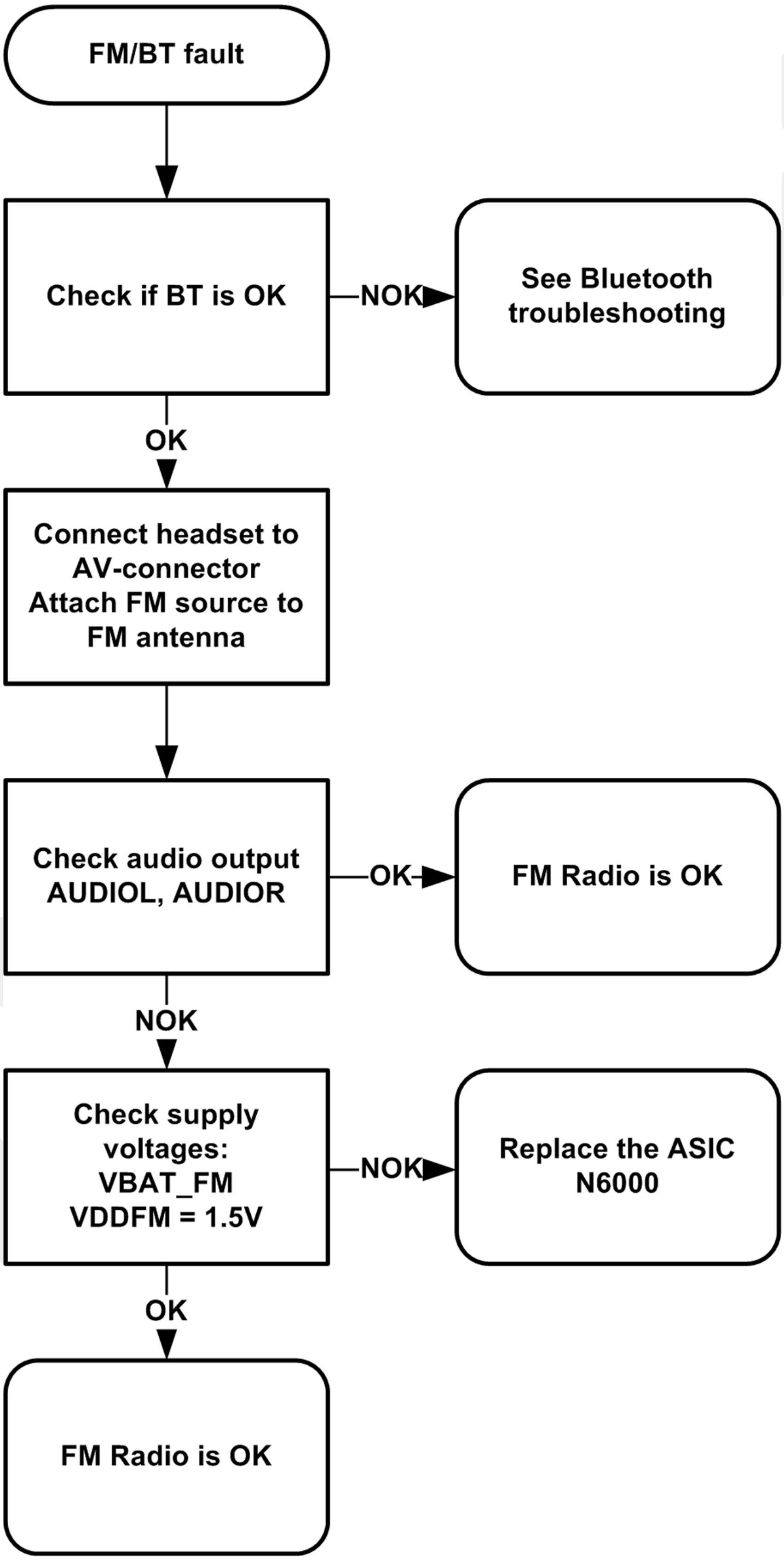

BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER <0.1%
OK
Bluetooth is OK
NOK
OK
Check Supplies: VBAT_BT=battery V. VIO_BT=1.8 V REFCLK_1 38.4 MHz, >400 mVpp
OK
BER< 0.1%
NOK
Replace the ASIC N6000
OK
Bluetooth is OK

Figure 21 Troubleshooting diagram: Bluetooth

FM radio troubleshooting

Troubleshooting flow


FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to AV-connector
Attach FM source to FM antenna
Check audio output AUDIOL, AUDIOR
OK
FM Radio is OK
NOK
Check supply voltages:
VBAT_FM
VDDFM = 1.5V
NOK
Replace the ASIC N6000
OK
FM Radio is OK

5 — System Module

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  Keyboard ... 5–12
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Introduction

Phone description

RAP is the main digital baseband ASIC in the phone. It contains functionality for GSM EDGE.

N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Key components

Function	Description	Item ref
Main board	2fra	
Energy management ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	RF IC	N1001
Processor	RAP3GS v23.1	D2800
PA GSM	Front end module (FEM), quad band	N1002
Memory	512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP)	D2802
Bluetooth	BCM2048	N6000
Battery	BL-4CT 860 mAh	
Battery connector	Blade interface	X2070
µUSB connector	For data	X2002

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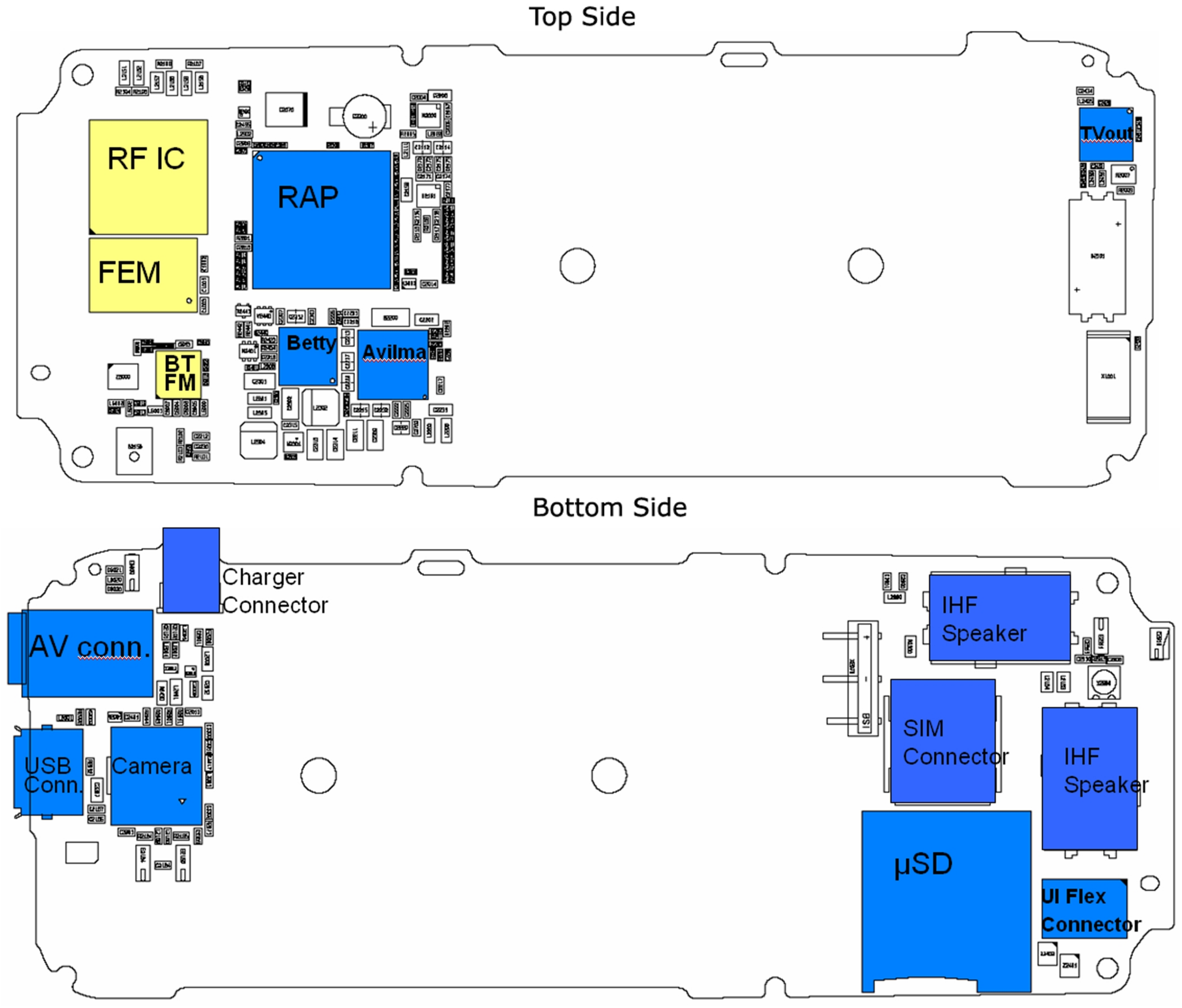
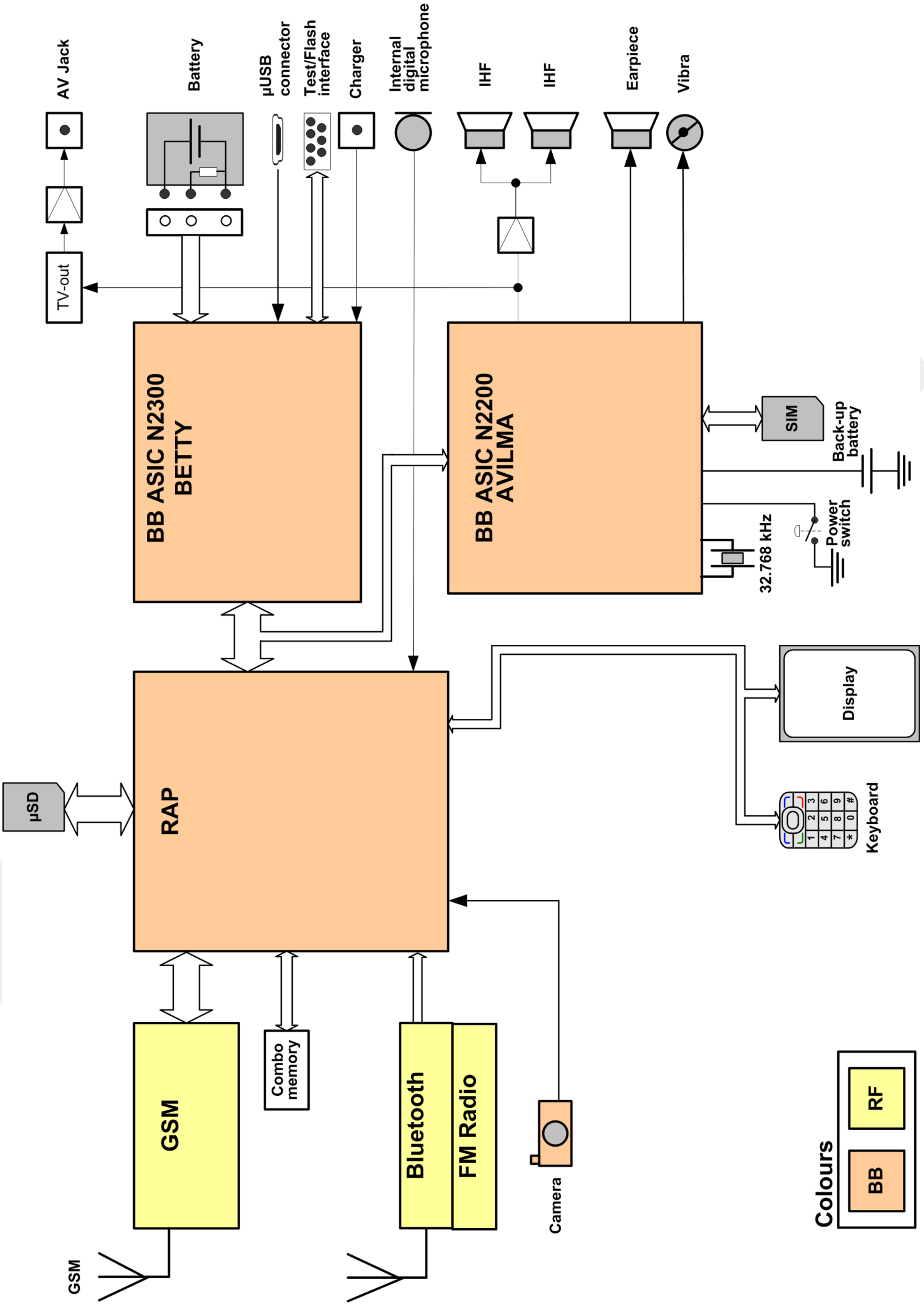
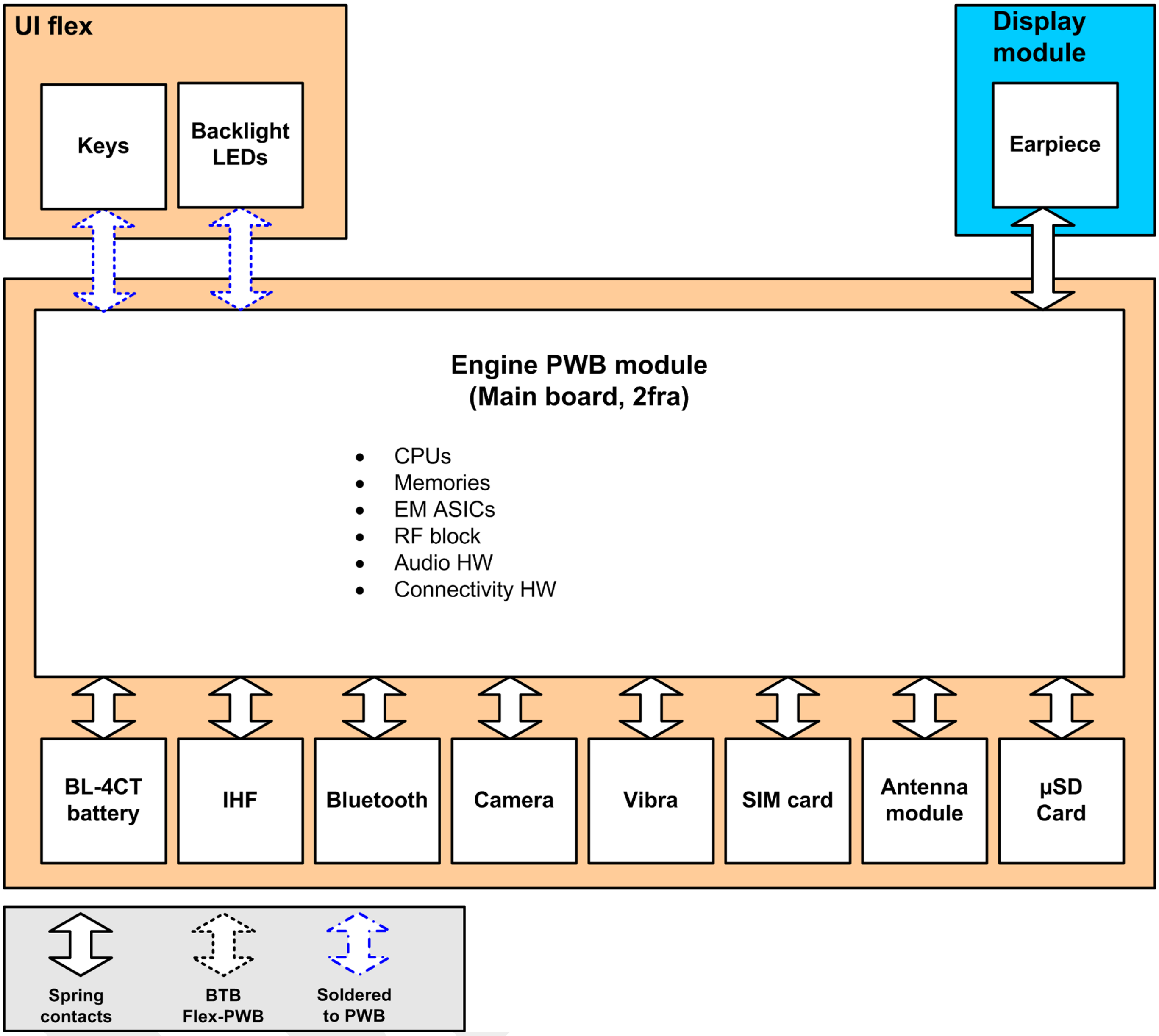
Key component placement


Top Side
RF IC
FEM
RAP
Betty
Avilma
BT FM
TVout
Bottom Side
Charger Connector
AV conn.
USB Conn.
Camera
IHF Speaker
SIM Connector
IHF Speaker
µSD
UI Flex Connector

System module block diagram


AV Jack
Battery
µUSB connector
Test/Flash interface
Charger
Internal digital microphone
IHF
IHF
Earpiece
Vibra
TV-out
BB ASIC N2300 BETTY
BB ASIC N2200 AVILMA
SIM
Back-up battery
Power switch
32.768 kHz
Display
Keyboard
µSD
RAP
GSM
Combo memory
Bluetooth
FM Radio
Camera
GSM
Colours
BB
RF

Board and module connections


UI flex
Keys
Backlight LEDs
Display module
Earpiece
Engine PWB module
(Main board, 2fra)
CPUs
Memories
EM ASICs
RF block
Audio HW
Connectivity HW
BL-4CT battery
IHF
Bluetooth
Camera
Vibra
SIM card
Antenna module
µSD Card
Spring contacts
BTB Flex-PWB
Soldered to PWB

Energy management

Battery and charging

BL-4CT battery

The phone is powered by a 3-pole BL-4CT 860 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

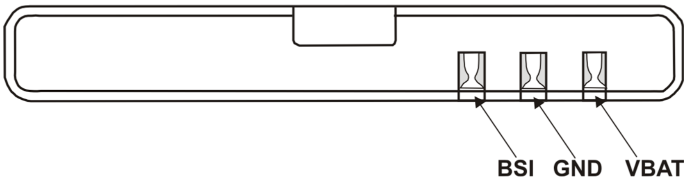


Figure 22 Battery pin order

The battery temperature can be measured from the UI flex.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

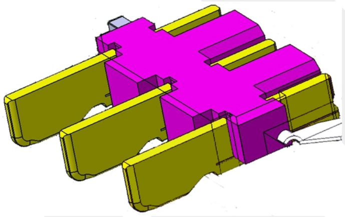


Figure 23 Battery connector

Charging

This phone is charged through a separate charger connector.

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-4CT battery is used.

Table 7 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	4.0	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off

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Voltage	Voltage [V]	Condition
SW Shutdown Voltages		
Sw shutdown	3.106	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system’s activity is low.
FLASHING	FLASHING mode is for SW downloading.

USB, SIM, µSD

Micro USB

The micro USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for µUSB.

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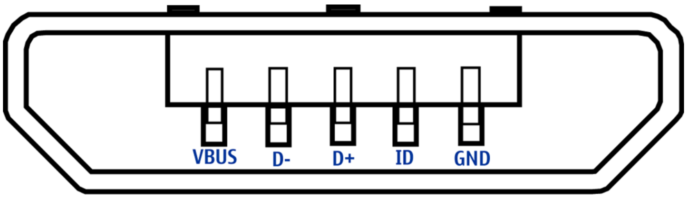

VBUS
D-
D+
ID
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC AVILMA (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

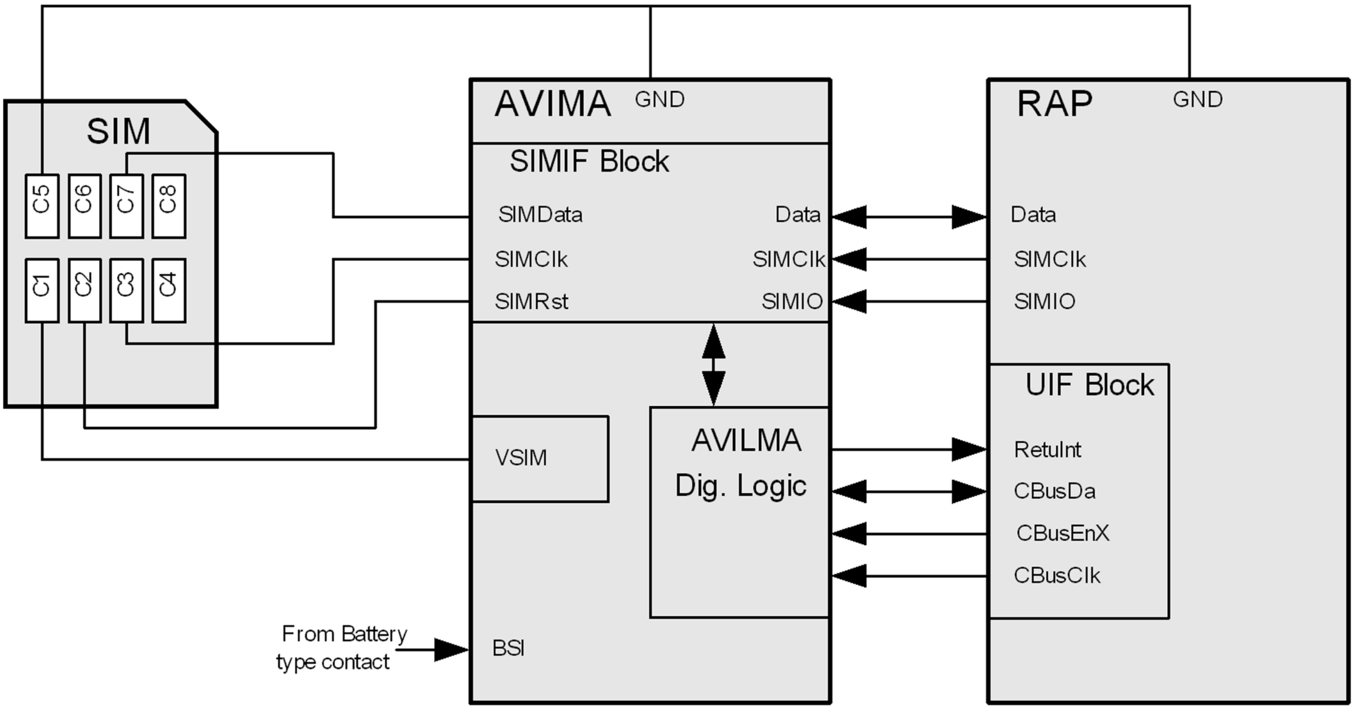
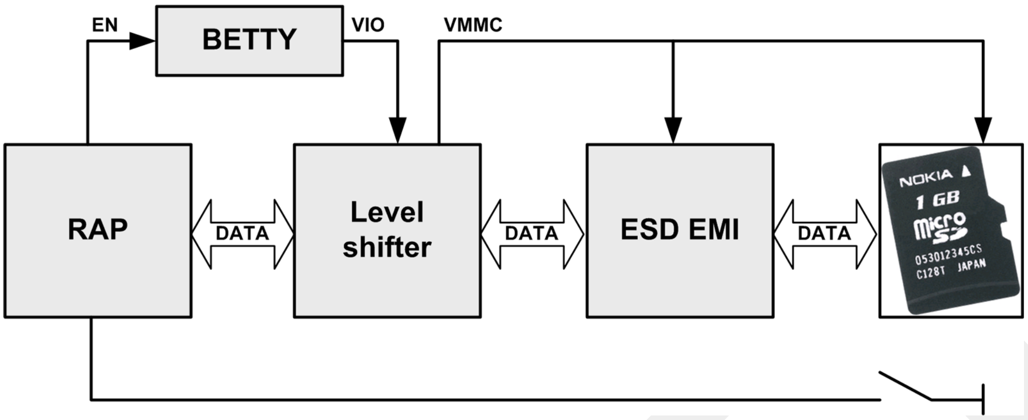

SIM
C5
C6
C7
C8
C1
C2
C3
C4
AVIMA
GND
SIMIF Block
SIMData
SIMClk
SIMRst
Data
SIMClk
SIMIO
VSIM
AVILMA
Dig. Logic
From Battery
type contact
BSI
RAP
GND
Data
SIMClk
SIMIO
UIF Block
RetuInt
CBusDa
CBusEnX
CBusClk

Figure 24 SIM interface

The EM ASIC AVILMA handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

µSD card interface


EN
BETTY
VIO
VMMC
RAP
DATA
Level shifter
DATA
ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The card removal is detected by a push detect switch.

User interface

Display module

The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.

The LCD module does not require any tuning in service.

Keyboard

Table 8 Key signal matrix

GENIO	ROW	Col_0 (GENIO-39)	Col_1 (GENIO-40)	Col_2 (GENIO-41)	Col_3 (GENIO-42)
32	ROW0	Left SK	Left	Right SK	Up
33	ROW1	Send	Right		Down
34	ROW2	1	2	3	Centre
35	ROW3	4	5	6	Vol +
36	ROW4	7	8	9	Vol -
37	ROW5	*	0	#	

Backlight and illumination

There is backlight illuminating for the display consisting of 4 LEDs.

The keypad is consisting of 4 LEDs.

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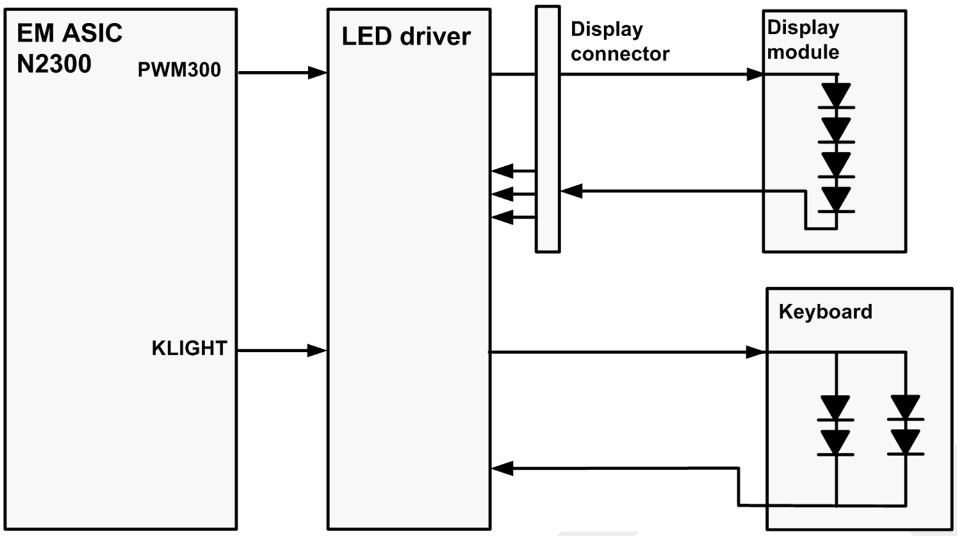
EM ASIC
N2300
PWM300
KLIGHT
LED driver
Display
connector
Display
module
Keyboard

Audio concept

This phone has a conventional solution on earpiece and vibra. Both are handled by AVILMA N2200. Two integrated handsfree speakers are driven by an additional amplifier also handled by AVILMA. The microphone has a digital interface and its RF-filtered lines are directly connected to RAP D2800 for processing.

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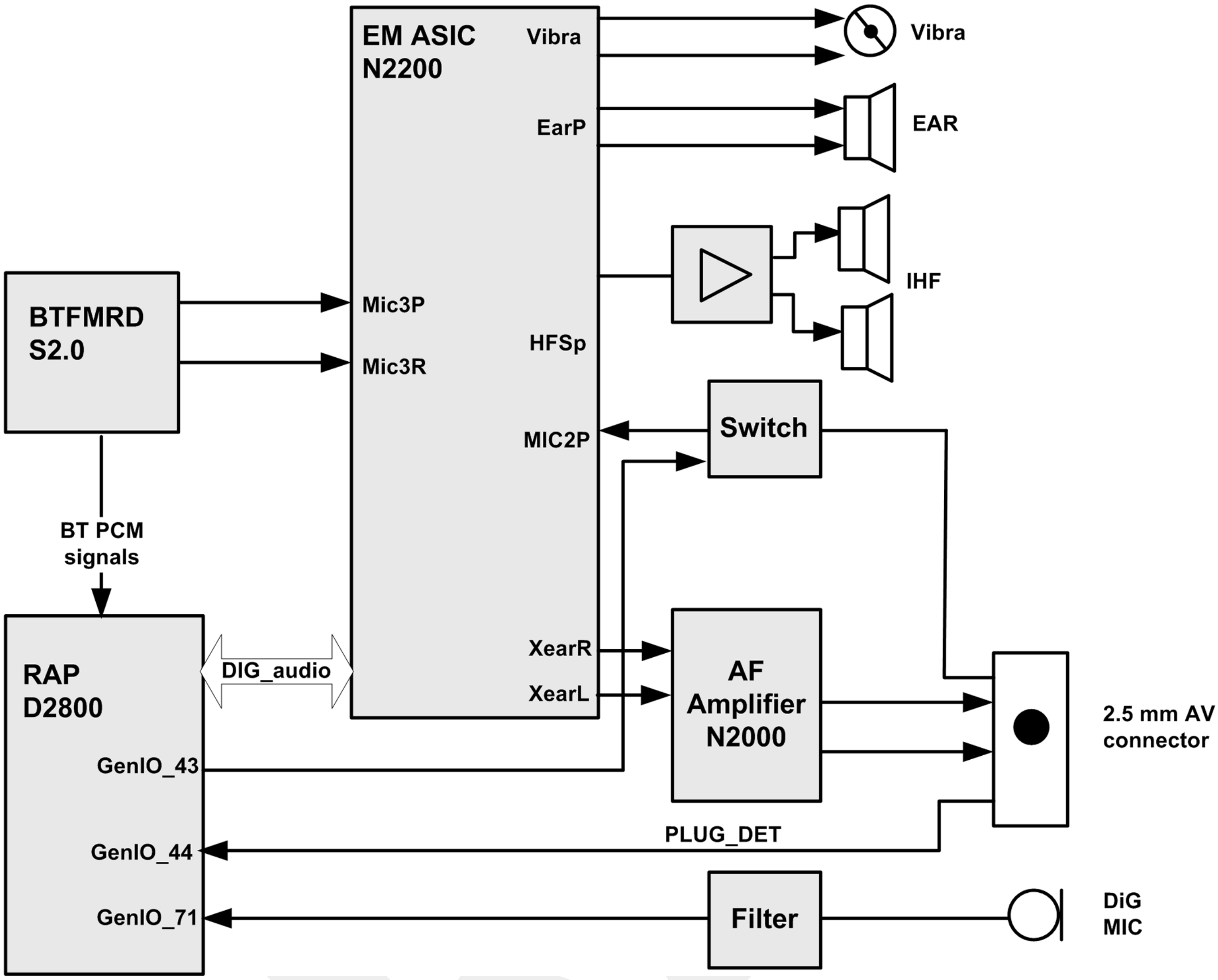

EM ASIC
N2200
Vibra
EarP
Mic3P
Mic3R
HFSp
MIC2P
XearR
XearL
Vibra
EAR
IHF
BTFMRD
S2.0
BT PCM
signals
RAP
D2800
DIG_audio
GenIO_43
GenIO_44
GenIO_71
Switch
AF
Amplifier
N2000
2.5 mm AV
connector
PLUG_DET
Filter
DiG
MIC

Figure 25 Audio block diagram

AV connector

The AV connector is used to connect headsets both in the handsfree phone function and for using the phone as a media player (see the audio concept heading). The six pins are used in accordance with the table below.

A connected male connector is detected on pin 6 (PLUG_DET).

Note: Only use an approved cable for connecting to the AV connector (e.g. headset HS-47).

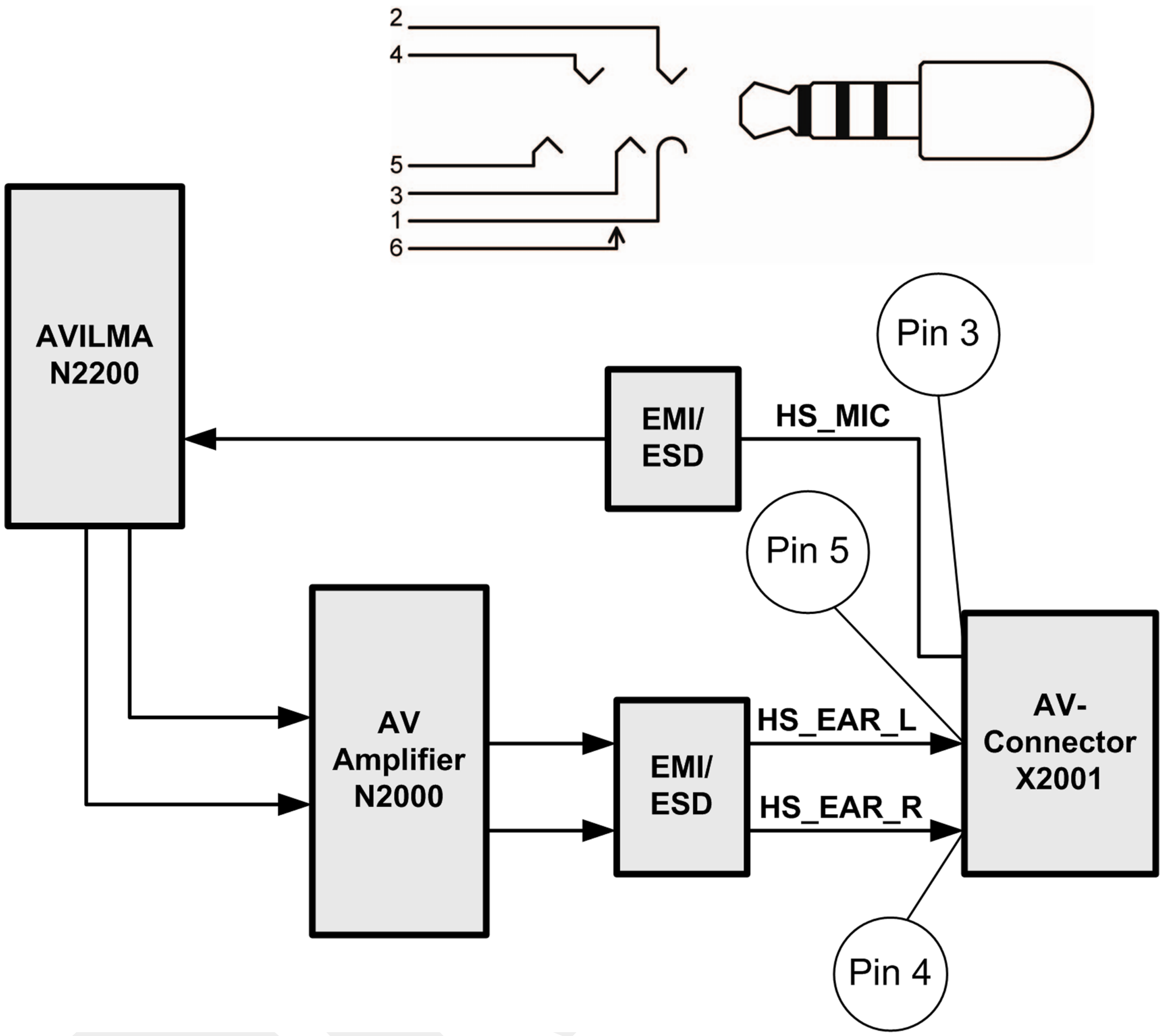

2
4
5
3
1
6
AVILMA
N2200
EMI/
ESD
HS_MIC
Pin 3
Pin 5
AV
Amplifier
N2000
EMI/
ESD
HS_EAR_L
HS_EAR_R
AV-
Connector
X2001
Pin 4

Table 9 AV connector pins

Pin	Signal name	Direction	Description
1, 2	HS_ GND	-	Ground)
3	HS_MIC/TVout output	Input/ Output	Microphone/ TV out output
4	HS_EAR_R	Output	Audio out
5	HS_EAR_L	Output	Audio out
6	PLUG_DET	Input	Plug detection

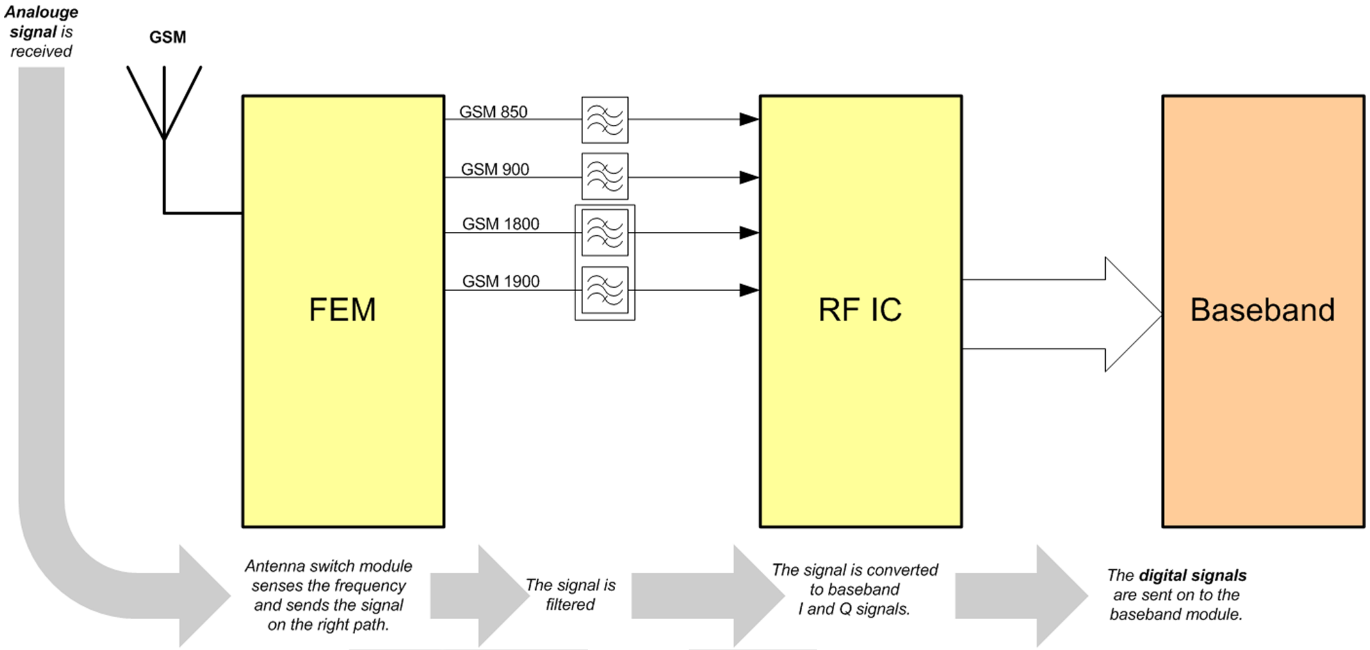
RF description

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

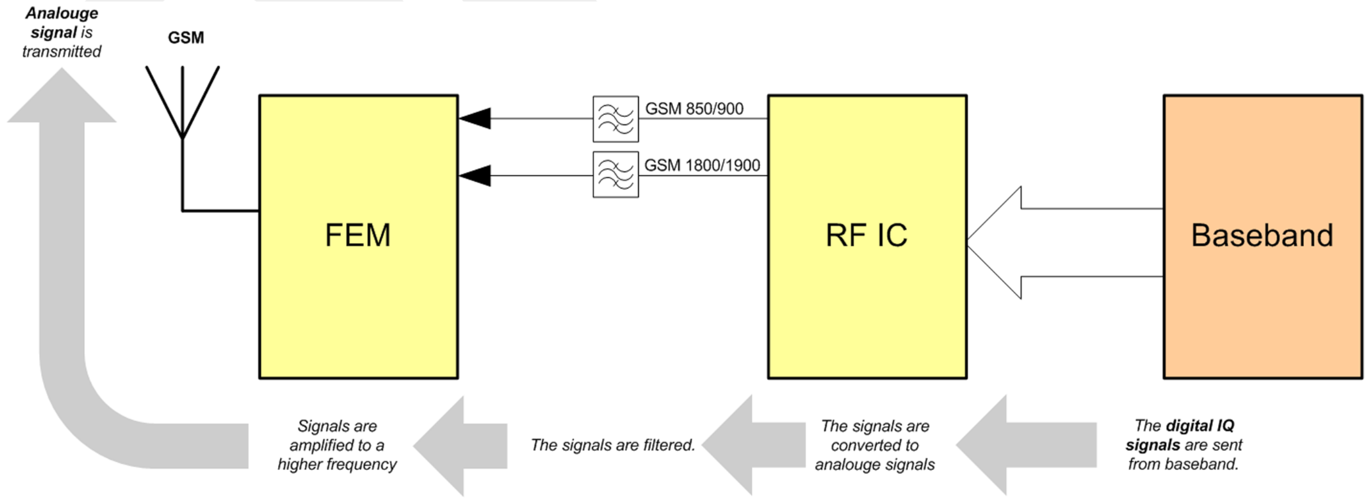
Signals with different frequencies take different paths, therefore being handled by different components.


Analouge signal is received
GSM
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
RF IC
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.


Analouge signal is transmitted
GSM
FEM
GSM 850/900
GSM 1800/1900
RF IC
Baseband
Signals are amplified to a higher frequency
The signals are filtered.
The signals are converted to analouge signals
The **digital IQ signals** are sent from baseband.

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

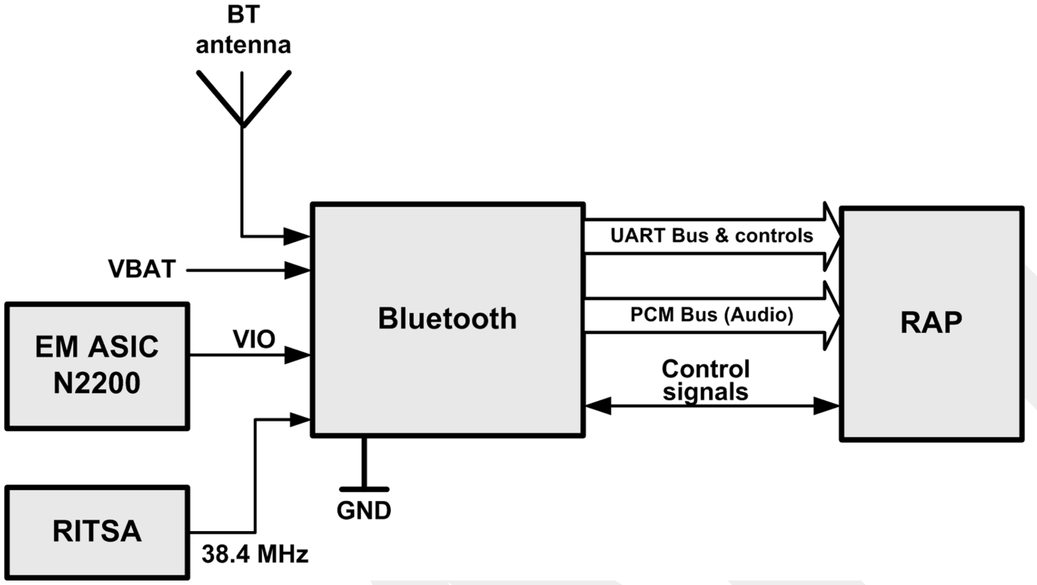


Figure 26 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/transmitter) is used for data communication and controls.

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BL-4CT 860 mAh Li-Ion battery pack	103.8 x 44.7 x 9.9	70.2	44.8

Battery endurance

Battery	NMP Talk time	NMP Standby time
BL-4CT 860 mAh Li-ion	Up to 5.4 Hours	12.5 Days Music 12 Hours

Note: Variation in operation times will occur depending on SIM card, network settings and usage.

Main RF characteristics for GSM band phone

Parameter	Unit
Cellular system	EGSM850/900/1800/1900

Parameter	Unit
RX frequency band	EGSM850: 869- 894 MHz
	EGSM900: 925- 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
TX frequency band	GSM850: 824- 849 MHz
	GSM900: 880- 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
Output power	GSM850:+5...32.5 dBm
	EGSM900:+5...32.5 dBm
	GSM1800: +0 ... +30 dBm
	GSM1900: +0 ... +30 dBm
Number of RF channels	GSM850: 124
	EGSM900: 172
	GSM1800: 375
	GSM1900: 300
Channel spacing	GSM 200 KHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 °C ... +55 °C	Specifications fulfilled
Reduced performance	55 °C ... +70 °C	Operational only for short periods
Intermittent or no operation	-40 °C ... -15 °C and +70 °C ... +85°C	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 °C and >+85 °C	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 °C ... +55 °C	
Long term storage conditions	0 °C ... +85 °C	

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Environmental condition	Ambient temperature	Notes
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

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DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

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IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

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VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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